

PC MAGAZINE

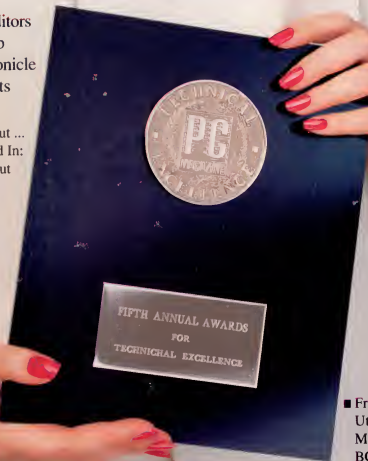
VOLUME 8 NUMBER 1
JANUARY 17, 1989

**PC Magazine's Editors
Pick the Year's Top
Products and Chronicle
Its Lesser Moments**

■ **While You Were Out ...
Voice Mail Stepped In:
PC Labs Checks Out
7 Systems**

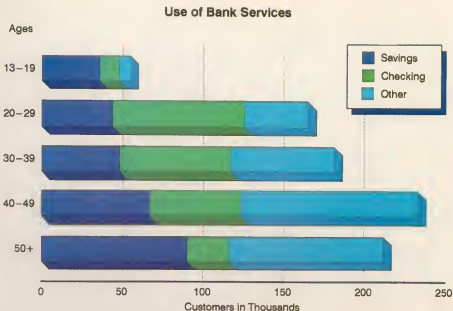
■ **IBM's PS/2
Model 30 286:
The Classic Bus
Is Back**

State of the Art, State of the Industry: **1988 Products Shaping the '90s**



■ **Free TSR
Utility:
Multitask with
BCOPY's
Background
File Copying**





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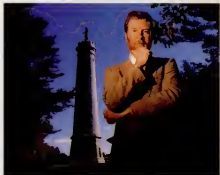
WHAT'S INSIDE

Will Zachmann is in the business of predicting the future of computing. In 1983 that meant forecasting gloom for minicomputer makers in the face of networked PCs, and in 1987 it meant taking a pessimistic view of IBM's plans for the OS/2 Extended Edition.

In 1989 Zachmann's prognostications and world view will appear in these pages, joining the regular columns of Bill Machrone, Jim Seymour, John C. Dvorak, and Stephen Manes. In his debut column, Zachmann stakes out the microcomputer landscape as he sees it—the site of a war for the control of standards.

Not to be outdone, the rest of the staff are starting off the new year with their own opinions. In our fifth annual best-of-the-year survey, *PC Magazine's* editors carry on the tradition of selecting the finest products of the past 12 months. By no means are these products solely the personal favorites of the editors who write about them here. Our senior staff, contributing editors, and other frequent contributors to *PC Magazine* started with a list of the year's Editor's Choices. They then nominated new products that hadn't completed formal review cycles.

To lead off the "Best of 1988" product summaries, executive editor Bill Howard lends his PC savvy and insight to the trends, events, and products that made 1988 memorable. You'll find the results of our "State of the PC, 1988" PC MagNet survey an intriguing snapshot of where the industry stands at year's end.



Will Zachmann at home near the Myles Standish monument in Duxbury, Massachusetts: "He lived just up the road from us, though a little before my time."

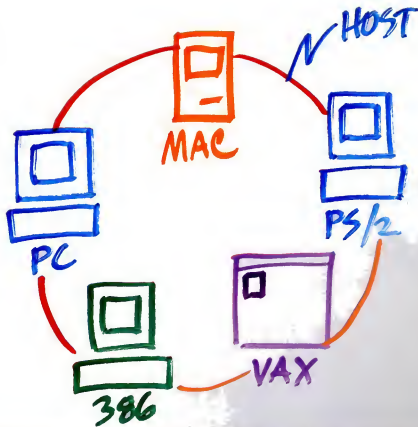
At Fall Comdex in Las Vegas, *PC Magazine* presented its Fifth Annual Awards for Technical Excellence. These awards salute those visionaries responsible for the creation of innovative products.

To choose the nominees and winners for the 1988 awards, our editors debated which products have advanced the state of the art most in the PC industry. In this issue Bill Machrone, our editor-in-chief and publisher, summarizes the merits of the winners and finalists in each category.

How can voice mail improve your business communications? We sequestered contributing editor and communications guru M. David Stone in PC Labs for several months so that we could find out. Stone emerged with the definitive view of PC-based voice mail systems presented here.

As part of our commitment to give you the best possible library of utilities, the Productivity section offers BCOPY, a TSR that lets you continue your work uninterrupted while DOS copies files in the background. BCOPY shows just how flexible DOS can be. —Catherine D. Miller

PC Magazine: The Independent Guide to IBM Standard Personal Computing (ISSN) #0898-8505 is published bi-weekly except in July and August for \$79.97 for one year (22 issues), \$81.97 for two years, and \$141.97 for three years. Additional postage \$1.40 per copy, or \$22.00 per year for Canada and all other foreign countries. 20% Discount Publishing Co., a Division of 200 Communications Co., One Park Ave., New York, NY 10016. Second Class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes in PC Magazine: P.O. Box 54061, Boulder, CO 80521-0406.



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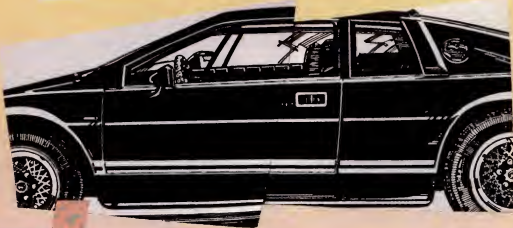
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Cover Photograph:
Roberto Brosan



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- *NewViews* adds payroll accounting, crash recovery
- Add PostScript to nearly any printer for under \$500
- *Per-FORM* forms processing
- Aurora 1024 display adapter
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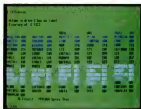
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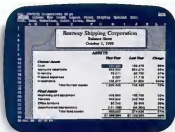
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Sauces	SA-111	Hollandaise			
	SA-121	Bearnaise			
	SA-131	Bordelaise			
	SA-141	Carolina Dashi			
	SA-151	Texas Barbecue			
	SA-161	Cumberland			
	SA-171	Aloli			
	SA-181	Pesto			
	SA-191	Carbonara			
Condiments	C-111	Japenese			
	C-121	Mustard			
	C-131	Onion			
	C-141	Pepper			
	C-151	Pickles			
	C-161	Relish			
	C-171	Soy Sauce			
	C-181	Tabasco			
	C-191	Vinegar			
	C-201	Worcestershire			
	C-211	Yogurt			

ing Corporation Stock Sheet per 1, 1988

ASSETS	This Year	Last Year
Cash	247,295	128,475
Accounts Receivable	663,552	534,750
Inventory	79,071	61,750
Prepaid Expenses	9,357	11,718
Other Assets	106,577	31,254
Total Assets	1,006,448	748,498
Liabilities		
Accounts Payable	229,395	189,750
Notes Payable	429,500	248,750
Other Liabilities	60,240	66,400
Total Liabilities	(719,135)	(464,900)
Net Assets	287,313	283,598
Per Share	\$1,299.999	\$1,728.000

LIABILITIES AND SHAREHOLDERS' EQUITY	This Year	Last Year
Accounts Payable	429,500	248,750
Notes Payable	429,500	248,750
Other Liabilities	60,240	66,400
Total Liabilities	(719,135)	(464,900)
Shareholders' Equity		
Common Stock	429,500	248,750
Retained Earnings	429,500	248,750
Total Shareholders' Equity	849,000	713,400
Total Liabilities and Shareholders' Equity	1,298,135	1,188,300

The Atlantic Group of Mutual Funds Stock Funds - October, 1988

Total Return	Capital Growth	Overseas and Growth
1988 (ytd annualized)	1988 (ytd annualized)	1988 (ytd annualized)
1987	1987	1987
5 Years to Date	5 Years to Date	5 Years to Date
10 Years to Date	10 Years to Date	10 Years to Date
Net Asset Value: 8/31/88	Net Asset Value: 8/31/88	Net Asset Value: 8/31/88
Dividends	Dividends	Dividends
1988 Income	1988 Income	1988 Income
1988 Capital Gain	1988 Capital Gain	1988 Capital Gain
1987 Income	1987 Income	1987 Income
1987 Capital Gain	1987 Capital Gain	1987 Capital Gain
# Months Dividend Paid	# Months Dividend Paid	# Months Dividend Paid
# Months Cap Gain Paid	# Months Cap Gain Paid	# Months Cap Gain Paid
Fund Facts	Fund Facts	Fund Facts
Quotation Symbol	Quotation Symbol	Quotation Symbol
Fiscal Year End	Fiscal Year End	Fiscal Year End
Current Prospectus Date	Current Prospectus Date	Current Prospectus Date
Assets (\$000)	Assets (\$000)	Assets (\$000)
Shareholders	Shareholders	Shareholders
Min Initial Investment	Min Initial Investment	Min Initial Investment
Min Subsequent Investment	Min Subsequent Investment	Min Subsequent Investment
Letter of Intent	Letter of Intent	Letter of Intent
Right of Accumulation	Right of Accumulation	Right of Accumulation
Exchange Privilege at NAV	Exchange Privilege at NAV	Exchange Privilege at NAV



“Give us one good reason
why we should buy
Macola Accounting Software.”



“How about five great ones?”

Choosing the right accounting software can be a complicated process. And due to the time and money invested, this decision should be made only once—regardless of how much your business grows.

There's plenty of excellent reasons to buy Macola Accounting Software. Here's five great ones.



Reason 1: Flexible and Powerful. In the words of PC Magazine, Macola Accounting Software “is at the top of its class... a flexible, powerful system that is well suited to many different businesses.”

Reason 2: Thirteen Integrated Modules. It's modular, so you can add more computing power as your needs grow, from simple accounting to full scale accountability.

Accounting General Ledger—Accounts Receivable—Accounts Payable—Payroll—Assets/Depreciation

Distribution Inventory Management—Customer Order Processing—Purchase Order and Receiving

Manufacturing Bill of Material Processor—Material Requirements Planning—Master Scheduling—Shop Floor Control—Job Costing

That's not all. There's a Report Writer that allows customized reporting and can easily transport data files to popular spread sheet, word processing and database programs.

Reason 3: The best multi-user LAN compatibility. No other software can match Macola's 15 years of maturity in mini and micro Local Area Network (LAN) environments. Today, Macola is the most advanced accounting software for LANs. No limitations, no compromises.

Reason 4: Unparalleled Speed and Data Integrity. Macola Software is the only high-end accounting software written in Micro Focus COBOL... for maximum speed and data integrity. Source code is available. IBM has licensed Micro Focus COBOL

as its SAA standard for the new PS/2 and OS/2.

Reason 5: Comprehensive Support. Toll-free 800-line support is available from Macola. Or, utilize Macola's nationwide network of authorized resellers for local training, customization and hands-on support.

These are just five of the many great reasons why Macola Accounting Software is the right choice for your business. For more detailed information, “live” demonstration modules and an authorized reseller in your area, call today:

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CIRCLE 263 ON READER SERVICE CARD

THE BUS STOPS HERE!

CompuStar: PS/2 and PC/AT Compatibility.

Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT* bus is your best buy but, then again, the new PS/2* bus may become the next industry standard." Great advice, right? If trying to decide on a microprocessor weren't tough enough, now you're expected to pick a bus, too.

RELAX, NOW THERE'S COMPUSTAR.*

The all new CompuStar from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or... both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the wrong computer system!

FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to 16 megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. Nobody but Wells American gives you this kind of value.

A CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use both buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Under configuration, the CompuStar can have up to 13 bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT and PS/2 slots. No

matter which bus becomes the next industry "standard," you'll have peace of mind knowing your investment in a CompuStar will be protected.

The CompuStar is also easily expanded. That's because there are seven CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that will leave more room on your desktop than any of the so-called "desktop" models.

A NEW IDEA FROM AN OLD COMPANY.

The CompuStar® Multi-Processor, Convertible Bus™ Microcomputer. It's no surprise that our engineers invented it. After all, we've been making microcomputers longer than anyone else... even longer than IBM! And if that kind of experience doesn't impress you, CompuStar's service programs surely will. You can select an optional overnight module swap-out plan or on-site service from General Electric Corporation — one of the most respected names in consumer electronics. And, of course, every CompuStar carries a full one-year factory warranty.

FINALLY, AFFORDABLE TECHNOLOGY.

Think all this technology sounds expensive? It's not. CompuStar 20MHz 80286 systems start as low as \$1995†. There are also inexpensive 8086 and powerhouse 25MHz 80386 systems available. Plus,

there is a wide variety of CompuStar display, tape and disk options including a one gigabyte erasable optical disk. You can choose a factory pre-configured CompuStar or custom design one yourself. Just unlock the front panel and literally "snap-in" a bus, CPU, memory or disk module in a matter of seconds. It's system flexibility never before available... at any price.

While one of our competitors (we won't mention any names) threatens you with "missing the bus," most simply pass the bus. Our new CompuStar, however, eliminates the bus problem altogether. Not to mention the processor problem. Even the expansion problem. Prove it to yourself. Call today about our 31-day trial offer. Oh, and by the way, the next time anyone asks, tell 'em you know where the bus stops.



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*Personal Computer AT, AT and PS/2 are trademarks of International Business Machines Corporation. †Photographs depict optional equipment. A complete price list is available upon request. CompuStar 80286 system (\$1995) includes an AT Bus Module, built-in VGA/EGA display adapter, one diskette drive with controller, two serial/parallel mouse port, keyboard and 220 watt power supply.

CIRCLE 51 ON READER SERVICE CARD

LETTERS TO PC MAGAZINE



BORDER SKIRMISHES

I would like to express my heartfelt gratitude for your lucid, well-informed exposé of the differences between Americans (good guys) and Canadians (scofflaws) ("Canada, O Canada," John C. Dvorak, *PC Magazine*, October 31, 1988). The only disturbing item I found in your column was the assessment that we are 8 years behind the Japanese!

I guess that I have been too busy illegally copying software to take the time to examine the differences between our countries. Your profound analysis has saved me the trouble.

Spencer Murray
Montreal, Quebec
Canada

Let's say that Mr. Canuck spends \$450 to buy *Lotus 1-2-3* ("Canada, O Canada"). If we assume that \$90 is the dealer's profit, then we know that \$300 has left the country for reinvestment in someone else's economy. The other \$60 has gone to Canadian taxes and is wasted since it won't be spent properly anyway. The net gain to Canada is \$90 circulating in the economy at a cost of \$450.

Compare this scenario with the following: Ms. Canuck, acting with only the best interest of her fellow Canadians at heart, rents a software program at a cost of \$15, tax free. She then pays an extra \$15 to have photocopies of the manual. To relieve her guilt about making an illegal copy, she contributes \$100 to the "Save the Beavers" fund.



If John C. Dvorak observed Canadians as being 4 years behind the United States in personal computing trends, it is probably because his entire Editor's Day was spent pumping quarters into a *Space Invaders* machine in the hotel lobby.

Bart Kitner
Montreal, Quebec
Canada

The concept of Canada's isolation is a myth ("Canada, O Canada"). We are computing at essentially the same rate as yourselves, and we all got our *Word-Perfect 5.0* updates at much the same time you did. Mr. Dvorak might be interested to learn that we actually have 386 PCs, and some of them are even 20 MHz!

I will, however, extend my apologies on behalf of Canadians if our "strange culture" offends your American sensibilities. We like to call it civilized (yes, that word is spelled correctly).

As for dressing the same and speaking "somewhat the way [you] do," I believe that that can be directly attributed to the fact that we all initially emigrated from the same country (you remember, "Mother England").

Mark Mullaly
Kitchener, Ontario
Canada

A country that could accept our Mary Pickford, Lorne Greene, and William Shatner and provide in exchange the comic genius of Charlie Chaplin, the Three Stooges, and Ronald Reagan can't be all bad ("Canada, O Canada").

We are also grateful for the American inventions of copy protection (which spawned Quaid), as well as viruses, bugs, and even Unix, all of which keep numer-

ous Canadian programmers and systems people from straining the resources of our unemployment insurance schemes.

Neil Charness
Waterloo, Ontario
Canada

John C. Dvorak's tarring of all Canadians with the Quaid Software brush is as valid as someone on this side of the border saying that Ivan Boesky is representative of all Americans ("Canada, O Canada").

H. M. Street
Ancaster, Ontario
Canada

OFF-BASE CRITIQUE

Donald Trivette stated that *MyBase*, the database package from Useful Software, "clearly lacks flexibility" (First Looks, page 56, *PC Magazine*, October 11, 1988). I have found the opposite to be true. Using the support that is provided by the program's author, I have even been able to use the program for applications not designed for *MyBase* with great success.

Richard J. Nickoloff
Woodland Hills, California



Saying that *MyBase* isn't useful because it won't import and export data with a program called *Hot Line* is like saying that Porsches are not good cars because they don't accommodate people over 6 feet 8 inches comfortably (First Looks). *MyBase*'s strength is not in its ability to import and export data, but in its ability to

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- 190 Make accurate job, cost estimates w/PCOSQuote, 640K.
- 201 Log bank transactions, produce financial reports w/Check
- 212 (2 disks) File Expense reports, move all purp database mpr
- 228 (2 disks) Friendly Dir. Data mail mpr w/easy-to-use, 640K.
- 234 Control & update inventory w/IT-Master, know daily levels
- 267 Add special chrs, line graphics to yr word processor w/QL
- 316 Manage clients, sales prospects w/Tracker/512K, 640K.
- 319 (2 disks) Keep appointments, update agendas w/EdiDisk
- 337 Analyze your credit charges, payments, interest w/Charge!
- 360 Track yr portfolio, get weekly reports w/Mutual Fund Mgr.

EDUCATION

- 186 It's painless learning DOS w/interactive DOS Tutor.
- 191 Learn music, US states w/PC-quizzar, Sign lang demo
- 228 Build dazzling typing speed practicing w/PC-Fasttype.
- 297 Graphic mathematical puzzle game makes learning fun!
- 355 It's simple to keep, average student grades w/Gradecheck
- 376 Teachers & students can summarize grades w/GradeMk
- 392 (2 disks) Edit graphics, colorize pics w/GAColor VGA

GRAPHICS

- 50 Display 3-D molecular structures w/Chemviz, EGA.
- 145 (2 disks) Paint, draw w/Fingerpaint, design w/Altairite.
- 228 Create advanced 3D designs! 640K, 1mb disk.
- 210 (2 disks) Produce grt 3D images w/Sunrindm graphics.
- 392 (2 disks) Edit graphics, colorize pics w/GAColor VGA

GAMES

- 15 Billionaire game tests knowledge of Bible figures/events.
- 29 Star Trek, Ortelio's board game, military bombing, EGA.
- 26 Play Backgrounder, or Wordplay (file wheel of fortune)
- 84 Three solitaire card games, Spider, Klondike, Canfield
- 121 Oubert, Pango, Centipede, Hooper (fr Frogger), more
- 151 Hack puts you & trusty dog in a wild adventure (fr Rogue)
- 176 Destroy enemies w/Skinner, conquer the world in Risk.
- 215 Solve, create own word puzzles with Phrase Craze!
- 289 3-D Pacman, Kong, Spacewar, ABM (missile control)
- 300 Roadzap (you set rules), ArmchairQB, imperial war
- 321 Star Trek, the original: Colossal Caves Adventure, more.
- 355 (3 disks) Create your own grt adventure games, 640K.
- 372 Planet, Ortelio, Dragons, Sogwith (fly sim), battleship

UTILITIES

- 136 Packed w/print utils for print spooling, banners, fonts, etc.
- 141 Print wide documents/spreadsheets sideways w/On-Side!
- 214 (2 disks) Search for addresses w/Zip-Phone card ref.
- 258 Work around DOS w/Easy Access hard disk menu sys.
- 275 A collection of invaluable general purpose DOS utilities.

MISCELLANEOUS

- 31 Movie Database lists 4,000+ films available on videotape
- 42 (fr disks) Access 8000+ famous quotes from world history
- 74 Trouble w/your landlord? Learn your legal tenant rights!
- 85 Add windows & give your Basic prog a professional look
- 146 PC-Lotto helps you mathematically beat state lotto add-on
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- 291 (2 disks) Record your own or play music w/ParanMail
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LETTERS

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Randy Lewis
Palo Alto, California

BUBBLE, TOIL, AND TROUBLE

Your review of the Canon BJ-130 is a recipe for disaster ("Dot Matrix Printers: The

My 8088 computer is fine, and I am not embarrassed that I still use DOS 1.1.

Market Matures," *PC Magazine*, October 31, 1988). First you tell us that the ink dissolves when wet, then that—when they see our output—our laser-loving friends will drool with envy. What happens when they drool on the output?

David Solomon
Selkirk, New York

NO MORE MUSH, PLEASE

I would like to respond to Mei Hsu's letter regarding a BTC keyboard review (*Letters*, *PC Magazine*, October 31, 1988). The "Mush Isn't Just for Dogsleds" letter seems to imply that only the casual user would describe the keyboard as mushy.

I am sure that the *PC Magazine* reviewer who wrote the article was not a casual PC user. I am a systems professional and have previously owned a BTC keyboard; the only way to describe it is "mush, mush, mush!"

John D. Thornburg
Hammond, Indiana

PCs FOR THE PEOPLE

Reader Patrick Anderson called himself one of the "real PC users" (*Letters*, *PC Magazine*, October 11, 1988): someone unable and unwilling to buy the latest over-priced hardware or software.

I must add my voice to his. My 8088 is fine, my *Volkswriter Deluxe* is able to do whatever I ask of it, and I am not embarrassed to add that I still use DOS 1.1. Like Mr. Anderson, I consider myself a real PC

user. By focusing on the corporate purchasing market, *PC Magazine* is passing up the real computer community.

Norman Isaacson
Warwick, New York

CHARITY BEGINS AT HOME

As someone who considers it an honor to live in the rural South, I resent the continued stereotype that we are the only place with poor schools and poor people. However, the idea that PCs could be put to better use in schools (*Inside Track*, *PC Magazine*, October 11, 1988) is excellent.

No doubt Antonia Stone, the executive director of Playing to Win, would agree. Playing to Win is a nonprofit center that teaches underprivileged youths the computer skills they need to keep up with the job market, and it is located right in your backyard: East Harlem.

Dennis Latham
Montgomery, Alabama

IN DEFENSE OF VOPI

Your benchmark test was a valid but extremely rare case; less than one-half of one percent of *VOp* users have reported the residual file fragmentation your reviewer described ("Order Out of Chaos: Boosting Performance with a Well-Ordered Disk," *PC Magazine*, October 11, 1988).

The review also misrepresents *VOp*'s TYPEME file and its approach to file fragmentation. The TYPEME file does not say *VOp* will leave fragments within files, but that it may leave empty clusters between files.

The last criticism was that *VOp* makes recovery of a deleted file impossible. True, but does that single fact justify a "second safety" rating?



Elizabeth G. Bryson
President
Golden Bow Systems
San Diego, California

HANDICAPPING DVORAK

In responding to Gary Perlman's comments on Unix, John C. Dvorak once more loads his gun, takes aim, and shoots him-

	1986	1987	1988
Asset Exchanges (Note D)	\$20,500	\$17,500	
Improvements	\$104,576	\$17,549	\$17,495
Installations (Note F)	\$4,500	\$17,500	
Additions to fixed assets	\$129,576	\$52,549	\$34,995

	1986
Income from operations	\$1,193,975
Interest and dividends	\$76,432
Income before income taxes	\$1,270,407
Provision for income taxes	\$472,606
Net income	\$797,801
Earnings per share	\$1.35

	1986	1987	1988
Sources of working capital:			
Net income	\$797,801	\$682,894	\$797,801
Non-food charges to income:			
Deferred income taxes	\$32,972	(\$37,568)	\$185,746
Depreciation and amortization	\$79,432	\$96,257	\$185,746
Working capital from operations	\$809,605	\$740,583	\$999,293
Sale of fixed assets	\$66,476	\$74,861	\$37,599
Issuance of common stock	\$7,044	\$43,438	\$34,866
Issuance of preferred stock	\$617,000		
Total sources	\$1,502,201	\$863,896	\$1,076,599
Uses of working capital:			
Additions to fixed assets	\$129,576	\$52,549	\$34,995
Additions to other assets	\$106,834	\$66,319	\$125,639
Dividends paid on capital stock	\$30,764	\$89,522	\$117,690
Total Uses	\$267,174	\$308,390	\$378,324
Increase in working capital	\$1,235,027	\$555,506	\$698,275

	1988
Summary Schedule:	
Land	\$250,000
Buildings	\$170,000
Furniture	\$72,000
Equipment	\$122,000
Other assets	\$6,000
Accounts receivable	\$17,000
Accounts payable	\$11,000
Other liabilities	\$5,000

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	1986	1987	1988
Net income	\$797,801	\$682,894	\$797,801
Interest and dividends	\$76,432	\$76,432	\$76,432
Income before income taxes	\$1,270,407	\$1,270,407	\$1,270,407
Provision for income taxes	\$472,606	\$472,606	\$472,606
Net income	\$797,801	\$682,894	\$797,801
Earnings per share	\$1.35	\$1.14	\$1.35

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Source: Power Meter MIPS Version 1.3. The Database Group, Inc.



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Janet Johnson, President
Coordinated Digital Systems
Dayton, Ohio



It's 11:05am. If you had our accounting software, you'd know where your business is.

11:05

"Great, back orders are down. Now let's push those sales."

11:06

"Gross Margins look good. We can pick up sales volume with some promotions."

4Payable MultiNet
Praxis Products, Inc.
Business Status Report as of 09/26/88

4Invoice/4Statements		4Payables	
Current Balance:	186532.63	Current Balance:	54632.21
PTD Billings:	55768.15	PTD Payables:	23656.44
PTD Receipts:	53422.23	PTD Payments:	25978.84
PTD COGS:	22475.84	Approved to Pay:	1285.95
Inventory Value	158412.57		

4Orders		4Purchase	
Open Orders:	8253.76	Open POs:	49783.56
PTD Orders:	54725.43	PTD Orders:	45125.33
PTD Shipments:	55835.12	PTD Receipts:	14937.49
PTD Gross Margin:	33292.31	Net Cash Forecast:	18378.62

Enter Choice (Forecast/Recalculate/Print/Quit) → 7

11:09

"Cash receipts are up, I can approve a few more P.O.s."

11:10

"Purchase Orders are close to sales this month. I'll call Mary and put the brakes on any more P.O.s for a while."

11:07

"Let's forecast where these numbers will be at the end of the month."

11:08

"Last week's cash forecast was \$4,000. We're looking much better. We can put some into CD's."

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LETTERS

self in the foot (Letters, *PC Magazine*, October 31, 1988). This is yet another time he has responded to criticism with silliness rather than intelligence. Perhaps if he spent less time reviewing (and eating) the free food at Comdex, he might not choose to equate volume with quality.

If Dvorak dislikes Unix so much, and yet doesn't seem to agree that MS-DOS is the answer, why doesn't he produce a good OS? We could call it "Good Operating System Dvorak" (G.O.D.S.)!

John A. McCulloch
Las Vegas, Nevada

It is conceivable that more single copies of Concurrent DOS have been sold, but if total terminals connected to either system are counted, Dvorak will have his explanation as to why Unix is a hot subject (Letters). When between 2 and 100 users are needed on one system, one can play games with Concurrent DOS, Multi-Link, and so forth, or one can get the system up and running on Unix.

Gary Alspach
Rockford, Tennessee

INSIDE SCOOP

In deference to your excellent review of graphics packages ("Desktop Solutions," *PC Magazine*, September 27, 1988), it is possible to put titles from the *Graph Plus* worksheet on any graph, but you will not find this in the Micrograph manual.

First, create a two-cell table chart with the first cell empty. You can then eliminate the axes and lines, choose any font size, and make the chart as wide as you need for longer titles. This creates a centered title so that when you update a worksheet, the titles are also updated.

Robert S. Vollowitz
Agoura Hills, California

A MAGNET FOR COMPLAINTS

I currently read eight magazines. I find that *PC Magazine* has the best in-depth articles and clear revisions, and I would like to commend the entire magazine staff. I do,

however, have one suggestion. Why doesn't *PC Magazine* have a BBS? Every one is running a BBS!

Marco Bitran
Chestnut Hill, Massachusetts

PC MagNet is a 24-hour-a-day on-line service where you can download the utilities and batch files printed in the magazine and converse with the magazine's editors. See this issue's Utilities column for details on signing up.

SHAKE IT UP, BABY

I agree that *Twist & Shout* is a fine product (First Looks, page 54, *PC Magazine*, October 11, 1988), but I was surprised that

■ If Dvorak dislikes Unix so much, and yet doesn't agree that MS-DOS is the answer, why doesn't he produce a good OS?

you didn't refer to the disk spooler feature that accompanies it. At my office, we find that part of it most useful and think it's a wonderful enhancement.

Daniel H. Dicker
Denver, Colorado

LABELING EPSON

"You can't use the Epson LQ-500 to print labels!" ("Dot Matrix Printers: The Market Matures," *PC Magazine*, October 31, 1988). After a call to Epson, I was informed that the LQ-500 will indeed print labels, and I have successfully printed them with mine.

Gene G. Krotchko
Birmingham, Alabama

HOW TO WRITE TO PC MAGAZINE

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■ JOE DESPOSITO

PC ADVISOR

How to survive a disk crash, advice on unattended communications between computers, and suggestions for upgrading the ROM BIOS of a vintage PC.

SURVIVING A DISK CRASH

Recently, I tried to boot my files disk on my Toshiba T1200F computer. To my dismay, the computer displayed a disk error. Does this mean that the disk is crashed and that I can't save my beloved files? Is there a program that I could use to save my files?

Joseph Abbo
Peoria, Illinois

You write that you are using a "files" disk. Normally, when you format a files disk (a disk used to store application files rather than programs), you use the FORMAT command without additional parameters. You cannot use a disk as a boot disk unless you format it with the /s parameter. So if you did not use FORMAT /s when you formatted the disk, you should expect a disk error when you start your computer with that disk in the boot drive (A:).

Also, since you are using a laptop computer with a 720K 3½-inch floppy disk drive, it's wise to check that your 3½-inch disk is one that was originally formatted on your computer. If it was formatted on an IBM PS/2 computer, for instance, your problem could stem from using a 1.4MB disk in a 720K drive.

If you truly have a crashed disk (one that should boot the computer but won't, or one that the computer cannot read), several things could be wrong with it. It may have a corrupted boot track, or a corrupted file allocation table (FAT), or be physically damaged (by a magnet, for example), and so forth.

There are many software programs specifically designed to recover data from

both floppy and hard disks that have crashed. A roundup of these products appeared in Winn L. Rosch's article "Back from the Brink: File Recovery Software" (PC Magazine, August 1987). List prices ranged from \$29.95 to \$150. Of course, if your disk has been physically damaged, there may be no data left to recover.

One of the programs reviewed in that issue, The Norton Utilities Advanced Edition (Peter Norton Computing, 2210 Wilshire Blvd., #186, Santa Monica, CA 90403; (213) 319-2000) has recently been upgraded to Version 4.5. Among its new features, it now includes a program called the Norton Disk Doctor (NDD), which automatically reconstructs your boot track if it has been corrupted. The Norton Utilities Advanced Edition lists for \$150.

IN THE STILL OF THE NIGHT

I am a software developer for a company that sells a real estate advertising database

■ There are many software programs designed to recover data from "crashed" (unbootable or unreadable) floppy or hard disks.

package. We need to access information input into a database on a remote computer. The information must then be transferred to our main computer via modem. We use IBM-compatible PC AT and PCXT computers.

I am looking for communications software that will give the calling computer power over the remote computer. The software must have a powerful command language. It should be able to tell the remote computer which files should be sent, and so forth. The calls will be done in batch form in the middle of the night, thus information transfer must be done completely without the intervention of a person. The program in the calling computer must be activated by the computer's clock.

Which software packages will give me the flexibility and power I need?

Scott D. Memmott
Redding, California

The January 12, 1988, issue of PC Magazine includes an article called "Remote Computing: The Next Best Thing to Being There," by M. David Stone. Six of the eight programs reviewed in that article are designed mainly for unattended remote operations of the type you are looking for.

The winner of the Editor's Choice in that article was PC Anywhere, from Dynamic Microprocessor Associates of New York (distributed by EKD Computer Sales & Supplies Corp., 764 Middle Country Rd., Selden, NY 11784; (516) 736-0500). PC Anywhere is designed for unattended-host operations but can also function for long-distance collaborations or support. It



■ PC ADVISOR

was the least expensive product of the group, with a retail price of \$99.

Depending on your "powerful command language," needs, investigate CoSession from Tritan Technologies Inc. (146 Maple Ave., Red Bank, NJ 07701; (201) 741-3232), also reviewed in the same article. CoSession can be used with Triton Technologies' Session/XL, a scripting and tasking communications language for automated file transfers, printing, and execution of programs and DOS commands. Other features include support of conditional statements, error checking, and command-line arguments and variables for automating remote PC-to-PC communication tasks and operations.

The list price of Session/XL, which works from the calling (host) PC, is \$225. The remote PC requires a CoSession Support or Application license. The Support license lists for \$175; the Application license lists for \$125.

UPGRADING A VINTAGE IBM PC

I own a 1981 vintage IBM PC that has fulfilled my needs until recently. I find that I need EGA capabilities not supported by the IBM ROM BIOS. Do you know a source of ROM BIOS chips that will update the computer?

If not, will changing the motherboard to one of the aftermarket ones advertised in PC Magazine solve the problem? Can you suggest which are the most compatible? A 4.77-MHz 8088 supplies all the speed I need for the word processing I do.

Jeffrey R. Crass
Stony Brook, New York


There is a way you can obtain the ROM BIOS upgrade you need. Self-Reliant PC Products (1750 Kalakaua Ave., #3-133, Hanalei, HI 96826; (808) 946-1808) sells authentic IBM BIOS chips for \$49.95 each. According to a spokesperson for the company, the chips were acquired at auc-

tion and are in limited supply.

Another way to obtain an IBM ROM BIOS is from someone who is upgrading an IBM PC with a 286 or 386 motherboard. You might know of someone who has done this or you could contact a local user group for members who have made this change.

If you decide to change your motherboard, make sure to select one that is intended for the IBM PC chassis and not the XT or AT. Remember, the PC chassis has only five expansion slot cutouts. Software compatibility on an aftermarket motherboard is determined chiefly by the ROM BIOS. Among the more compatible ones are the Phoenix BIOS and the Award BIOS.

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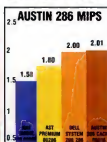
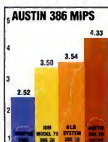
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FIRST LOOKS

Finally . . . dBASE Gets New Look, Adds WYSIWYG Reports, SQL

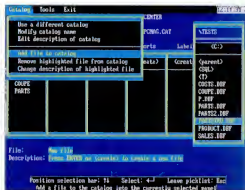
PC HANDS ON

BY RICHARD HALE SHAW

dBASE IV has finally arrived. The wait has been long and tiresome, but the finished product represents no less than a complete overhaul of this immensely popular package.

While the most obvious additions concern the user interface, you'll also find a host of other long-awaited enhancements.

In a change that gives *dBASE IV* a whole new look, the Control Center replaces the *dBASE III Plus* Assistant for organizing and displaying any database objects (files, views, forms, reports, labels, and programs). Developers can use this as an application front end,



The Control Center, which replaces the *dBASE III Plus* Assistant, provides a means of organizing all of your files, queries, reports, and applications.

while end users can use it to manipulate any facet of a database and virtually eliminate the need

to learn *dBASE* commands. The Control Center includes a file manager and directory display

as powerful as most DOS shells on the market.

dBASE IV also adds a WYSIWYG report and label designer, allowing you to create reports exactly as they will appear when printed. A report can include calculated fields, the system date, page numbers, summary fields, boxes, lines, menu styles, and printer fonts. Installable printer drivers allow you to switch quickly between four different printer configurations.

The on-line help now appears in windows, with options to choose related topics or print the help screen for reference. If you enter a command incorrectly, the help feature will let you edit the command, view the help screen for it, or cancel the

(continues on page 35)

NewViews Adds Payroll, Crash Recovery, NetBIOS Support

PC HANDS ON

BY LEE THE

NewViews, Version 1.12, updates the integrated, real-time accounting program and procedural language that won the 1986 *PC Magazine* Award for Technical Excellence.

This version adds Payroll, crash recovery, forced audit trails, NetBIOS LAN support (albeit as a single-user application), color support, improved manuals, a utility that improves

on DOS file handling with files larger than 2MB in size, and optional source code hiding for procedures (which resemble spreadsheet macros).

You can request a catalog that lists 131 third-party templates, procedures, utilities, and training aids, along with 142 North American consultants and training centers (70 of them in Canada).

NewViews puts financial and management reporting first. Most accounting packages put day-to-day bookkeeping first,

financial reporting second, and management reporting a distant third.

NewViews' priorities make sense, though. Improved bookkeeping can do wonders for cash flow by tracking receivables more tightly, but one great high-level decision guided by data from the accounting system could mean far more to a firm's success.

But it must be timely. So the whole system updates with each transaction (instead of the tradi-

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\$295 Publish It! Works Like Ventura Publisher, Stresses Ease of Use

PC HANDS ON

BY TAMI D. PETERSON

Publish It!, a \$295 desktop publishing package from Time-works, purports to be not only full-featured, but also so easy to use that you'll be cranking out your first document in less than an hour. Anyone who has already spent countless hours wrestling with an expensive DTP package may secretly wish this weren't true. But, for the most part, this package fulfills its promise.

As an added bonus, the package seems patterned after *Ventura Publisher*. Both products run under the GEM environment (included with *Publish It!*), employ the same modes of operation, offer the same style-sheet functionality, and use similar keyboard commands in the absence of a mouse. In short, if you know *Ventura*, you'll know *Publish It!*; if you know *Publish It!*, your learning curve to *Ventura* will be a lot flatter.

Publish It! is a page-oriented program. This means it is well suited to conventional layout applications like newsletters, brochures, advertisements, and office correspondence. While the feature set is strictly focused on the short-document market, it can reasonably handle the occasional longer document with such features as auto pages, style sheets, auto text flow, headers, footers, and wrap-around graphics. Controls for text kerning and line leading add further professional quality to this program.

Like *Ventura*, *Publish It!* utilizes four mode settings to perform all operations: Frame, Paragraph, Text, and Graphics. In a rare instance of *Publish It!* topping *Ventura*, the Text mode offers word processing features like Find, Word Count, and Global Search and Replace. The Graphics mode also boasts an unexpected gem or two, includ-

ing a freehand drawing tool.

Style sheets are a common element in all high-quality desktop publishing programs. This inexpensive program uses them in a logical and sophisticated manner that is occasionally

peating column guides, images, and text to appear on all pages.

Four different page layout sizes are available, in both portrait and landscape. Don't worry about changing your printer's orientation—*Publish It!* will let



Publish It! allows a wide variety of style-sheet paragraph options. You can include any of 15 unique bullet characters as part of a Paragraph Tag.

lacking in its more-expensive brethren.

Text, grouped by paragraphs, is "tagged" to automatically take on various character and line formatting. For instance, major headings throughout a document might initially be tagged with a style named Major Heading. Each Major Heading, once tagged, takes on the predefined look (for example, a 24-point bold font, centered in the column). The utility expands when the attributes of the style are later changed. If so, all major headings throughout the document will immediately transform.

Bullets can be incorporated as an attribute of a style, making short reports and presentations just a few mouse-clicks from completion. You choose from 15 different bullet characters—basic round dots to modern square boxes, in either solid, outlined, or shadowed silhouettes.

You'll also find a Master Page feature, which allows re-

peating column guides, images, and text to appear on all pages.

Six built-in fonts, ranging in size from 6 to 36 points, will support HP-compatible laser printers. A wide variety of 9- and 24-pin dot-matrix printers are also supported, as are PostScript printers.

This program does not rely solely on its intuitive nature to turn you into a desktop publisher. There are a multitude of aids to get you going. A well-written manual, a quick-start tutorial, extensive help menus on-screen, and a coherent reference card, all work to fulfill the less-than-1-hour pledge.

Publish It! bundles 150 line-drawings for use with the program. The documentation provides a printout of each one.

You can also import graphics from other sources. *Publish It!* supports PC Paintbrush, Lotus 1-2-3, and all GEM line and image formats. Text files can be read from Microsoft Word, WordPerfect, WordStar, AS-

CHI, as well as several other word processors distributed by Time-works.

Enclosed in the *Publish It!* package, you'll find a small catalog promoting other Time-works products. Among them are additional font packages, graphics libraries, and pre-designed style sheet bundles to get you started even more quickly. These add-on packages sell for \$39.95 each.

The bottom line? Companies that have standardized on *Ventura Publisher* have a rather interesting reason to consider this product. *Publish It!*, with its similarities to *Ventura's* interface and operations, may prove to be the perfect beginner's program. If upgrading were required at a later date, user retraining costs would be minimal, though documents could not be shared between the two applications.

Moreover, even on its own merit *Publish It!* compares favorably with some desktop publishing programs selling at three times the price. Within its own price range, *Publish It!* stands ahead of all the competition. ☐

PC FACT FILE

Publish It!
Time-works Inc.
444 Lake Cook Rd.
Deerfield, IL 60015
(312) 948-9200
List Price: \$295

Requires: 512K RAM, graphics card (mouse recommended), DOS 2.0 or later.

In Short: An economical, versatile, and easy-to-learn DTP program that's perfect for short documents. Its *Ventura Publisher*-like operation, as well as its impressive range of features, should appeal to corporate buyers. Not copy protected.

CIRCLE 446 ON READER SERVICE CARD

dBASE IV

(continued from page 33)

command entirely.

And of course, dBASE IV sports Structured Query Language (SQL), the database language used in IBM's mainframe database, DB2. SQL can access dBASE databases via an SQL mode, which allows a subset of dBASE commands and functions to remain active. The SQL implementation has the look and feel of DB2's SQL, and developers will be able to simplify programming chores by including SQL in their programs.

Less obvious at first glance are dBASE IV's data integrity controls. An AUTOSAVE option will keep disk files and DOS file allocation tables updated as you make alterations, eliminating vulnerability to power outages and system crashes. A transaction processing facility allows a developer to designate the starting and ending points of a transaction period, so a database can be rolled-back to its prior state, if desired.

A built-in compiler automatically converts dBASE IV program files (.PRG) into an intermediate object code and then recompiles them after modification. A full-screen, windowing debugger allows you to step line by line through programs, displaying the status of variables and stopping at up to ten break-

points. SQL program files (.PRS) are also accessible by the compiler and the debugger.

dBASE IV allows greater access to memo fields, which can be edited in a window and manipulated by a new set of functions. The editor (also used for

tangent, and pi, and take advantage of dBASE IV's floating-point data type.

Several additional features reduce the dBASE code required for a specific task. Lookup will search unselected databases; Scan will find records that meet

more than one simultaneous relation to another file.

Other improvements include automatic sensing of LIM expanded memory and a complete keyboard macro facility. Programs can be nested up to 256 levels deep, and the history can store up to 16,000 previous commands. Finally, dBASE IV can read and write Framework, Multiplan, and Lotus 1-2-3 file formats.

How does dBASE IV measure up? Although installation of dBASE IV is easy, it is time-consuming. Once finished, you'll find that the 14 disks occupy nearly 4MB of hard disk space.

dBASE IV features that will seem revolutionary to seasoned dBASE users are mere copies of those offered by competitive products. A dBASE IV "work surface" for constructing queries or views is a clone of the Paradox Query-by-Example (QBE). dBASE IV has two-dimensional memory arrays, but FoxBase has had these for some time.

The dBASE Browse and Edit commands will automatically refresh displayed data to reflect changes made by other users, but Paradox offered this in

(continues on page 34)

Logout	Organizer	Append	Go To	Edit	12:14:07 am	
Run	Field Name	Field Type	Top Field	Last Field	Field number	Index
1	TRANS_NO	Numeric	12			N
2	TRANS_ID	Character	20			N
3	NAME	Character	20			N
4	INDENT	Character	20			N
5	YEAR	Numeric	4	0		N
6	DATE	Character	20			N
7	COLOR	Character	10			N
8	UNIT	Numeric	4	0		N
9	BUYPRICE	Numeric	8	2		N
10	SELLPRICE	Numeric	8	2		N
11	TRANDATE	Date	8	2		N
12	REORDER	Numeric	5	0		N
13	REMARK	Character	1			N

dBASE IV provides pull-down menus from virtually anywhere in the program. Here they're used to modify a database structure.

programs) can handle larger files and offers block copy and move, and auto-indent. You can use either pull-down menus or the familiar Ctrl-key combinations.

A wealth of new commands and functions are available in dBASE IV, including user-definable menu functions and horizontal and pop-up menus. New mathematical functions can calculate standard deviation, future and present value, sine,

a specific condition; Calculate can perform several simultaneous mathematical operations on an entire database; Browse and Edit are more easily used in an application now, and you can switch between them with a single keystroke.

dBASE IV's database files allow each field to be an index key, with up to 47 keys stored in a single index file that dBASE IV updates automatically. In addition, database files can have



Performance Tests: dBASE IV vs. dBASE III Plus and R:base for DOS

dBASE IV's performance times show considerable improvement over those of dBASE III Plus, thanks to refinements in the indexing algorithm and index file structure. These changes, however, may also be responsible for dBASE IV's higher time in the Search test. All tests were performed on a 50,000-record file.

Performance Times

(Times given in seconds)

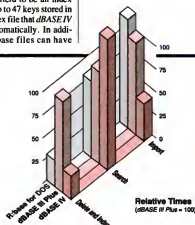
	Delete and Index	Search	Import
R:base for DOS	694.68	5.81	4,781.15
dBASE III Plus	2,401.00	7.00	4,041.00
dBASE IV	619.00	10.00	1,637.00

The Delete and Index (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and TranDate) from a Product table created for this task, and then to reindex the file if necessary.

The Search test measures the time it takes to locate the first record that satisfies two criteria (make = Ford and model = coupe).

The Import test measures how quickly the database can import an ASCII file (of either fixed-field length or

comma-delimited format) with an index on the first field. We included the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs required a two-step process for this test: an import followed by indexing.



dBASE IV*(continued from page 35)*

1987. As for user-defined functions, data validation, 255 fields per record, a configurable prompt, and a real applications generator—**dBASE IV** may have them now, but it certainly resembles a me-too effort from Ashton-Tate.

While you can mix up SQL and **dBASE** programs, SQL won't work with the **dBASE** runtime, eliminating it from use in standalone applications. And, while the inclusion of SQL provides a relational facade, one can hardly call **dBASE IV** relational. Indeed, Ashton-Tate has dropped this term from its description of **dBASE**.

The bottom line? Whether or not **dBASE IV** will be your DBMS of choice depends on your view of **dBASE** in general. If you're a die-hard **dBASE** fan, you'll love **dBASE IV**'s new features and 100 percent compatibility with **dBASE III Plus**. If you've already explored **dBASE** alternatives, you'll find the new features and improvements interesting. But the majority of the new features, except SQL, are available in existing products. Finally, if you're a relational database aficionado, you'd best stay away—this "somewhat-relational" DBMS is not for you. ☐

**FACT FILE****dBASE IV**

Ashton-Tate Corp.
20101 Hamilton Ave.
Torrance, CA 90502-1319
(213) 329-8000
List Price: \$795
Requires: 640K RAM, hard disk drive, DOS 2.0 or later.
In Short: **dBASE IV** adds a host of significant improvements over previous versions, including a new interface, WYSIWYG report design, automatic data integrity features, and a complete implementation of SQL. Not copy protected.

CIRCLE 436 ON READER SERVICE CARD

NewViews*(continued from page 33)*

tional batch mode). Monthly closing is strictly optional.

NewViews makes querying data intuitive. At boot you see a menu of reports, such as balance sheet, income statement, accounts receivable, accounts payable, changes in financial position, sales, cost of goods sold, inventory records, fixed assets, payroll tax withholdings, and payroll expenses schedule. Detail is maintained for 2 years (10 in summary form).

To look at the balance sheet report, you move the cursor to that heading and hit the Slash key. A bar menu appears. Highlight the Document command. (The others are Edit, Go, Block, Print, Cursor, and Window.) The Cursor Down key pulls down the Document menu. Go to Expand on it, hit Enter, and you get a window on the balance sheet report.

To access a particular balance sheet account, you use Document Expand again to open any line item on the report into a report on that item only. One more Document Expand and you're at the last level, looking at the actual transactions the bookkeeper entered for a given highlighted account.

At nearly any point, F1 brings up good context-sensitive help.

The distribution level is where you shovel in the raw data. "Goto" commands let you sidestep multitiered Document Expand sequences.

To generate needed reports, **NewViews** provides an impressive level of flexibility. You can create reports as templates, and the procedural language lets you build them into the system with plenty of bells and whistles. Dozens of templates with open source code come with the package.

Thus **NewViews** can be modified extensively without altering the core, protecting your access to **NewViews**' technical support. A quarterly newsletter also contains handy procedures, templates, and tips on writing your own.

Despite its virtues, **New-**

Name				Apr 26, 85
Document	Edit	Go	Block	Print
Expand				Cursor
Contract				Window
View				
Next				
Open				
Sheet				
Jump				
Lock				
Today's Date: Apr 26, 85				
Description				
Balance Sheet				
Income Statement				
Accounts Receivable				
Accounts Payable				
Changes in Financial Position				
Sales Schedule				
Cost of Goods Sold Schedule				
Inventory Records				
Fixed Assets				
Payroll Withholdings				
Payroll Records				
Z Reports				
Info & Help				
Name	Description			

The Home view of **NewViews** lists all available reports, which you can expand through the document submenu.

Views wasn't an Editor's Choice in our last special accounting software issue (September 15, 1987). And while our Price Waterhouse review (May 26, 1987) praised its flexibility and innovative design, it was criticized for weaknesses in execution and ease of learning, a certain clunkiness in day-to-day data entry, and the lack of system defaults (especially a sample set of account names and reports).

Version 1.12 addresses many of these problems, though I think the new version will not so much win new friends as increase the satisfaction of those who already like it. (One step backward: mouse support was abandoned, even though the point-and-shoot interface cries for it.)

NewViews still needs more procedures—especially to streamline basic bookkeeping functions. And like spreadsheet add-ins, procedures protect program source code sanctity at the expense of integration. The more useful ones need to join the core code. And **NewViews** still needs item inventory (promised a year ago). Moreover, invoicing still ages only from month of transaction rather than date of invoice—common in manual systems.

Q. W. Page contends that the program's apparent slowness is more than offset by the number of accounting steps it eliminates. Nonetheless, the faster the CPU and hard disk, the more you'll like **NewViews**.

Happy **NewViews** users (or VARs) are likely to be mavericks with a clear idea of how

they want to set up their accounting system. They have needs not met by orthodox offerings (such as Bedford's package), a willingness to invest in serious planning and setup time before starting to enter transactions, and a desire to use the procedural language to tweak the system on an ongoing basis.

With substantial refinement, the **NewViews** concept could appeal to a broader base of users. But it's taken Q. W. Page a long time to get this far. I get the feeling we're in for a long wait. ☐

**FACT FILE**

NewViews, Version 1.12
Q. W. Page Associates Inc.
1 St. Clair Ave. West
Toronto, Ontario
Canada
M4V 2Z5
(416) 923-4567

List Price: \$995 (with functional equivalent of General Ledger, Accounts Receivable, Accounts Payable, Payroll, Financial Inventory, Time and Billing, and Costing).
Requires: 512K RAM, hard disk, 80286- or 80386-based PC with hard disk faster than 400 milliseconds, DOS 2.1 or later (3.1 or later preferred).
In Short: The latest version of this unconventional accounting package adds long-awaited features such as payroll, crash recovery, LAN support, and color support. Not copy protected.

CIRCLE 438 ON READER SERVICE CARD

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Norton's Latest Adds Automatic Disk Repair, Smart File Recovery

PC HANDS ON

BY EDWARD MENDELSON

The NDD (Norton Disk Doctor) is the white-coated hero of *The Norton Utilities Advanced Edition*, Version 4.5. This ingenious program detects the great majority of errors or damage that can afflict a disk and, more often than not, automatically repairs the problem.

The rest of the \$150 latest Norton package is an evolutionary advance over Version 4.0. Enhancements include better help screens and menus, new programs that add control over keyboard and screen, and a safe formatter. The \$100 *Standard Edition* omits the NDD and other advanced programs for tuning and modifying disks, making it a safer choice for ordinary office use.

DOS's CHKDSK can disentangle some cross-linked files and fix other errors in the directory structure, but the Norton Disk Doctor does a more complete job. It also knows how to perform more drastic surgery.

The NDD can repair a disk's file allocation table by copying the normally unused second copy of the FAT over the first, edit the code that a disk uses to identify itself to DOS, and undo the disaster caused by DOS's misnamed RECOVER command. It can even repair the master partition table on a hard disk, or give you a bootable partition when none exists.

If you boot up your machine only to discover that your hard disk has no files or that DOS thinks the drive doesn't exist, a quick examination by the NDD can prevent you from making things worse. It senses when the disk parameters stored in CMOS RAM don't match the disk and warns you to run the setup program before proceeding. It can also peel off data from some disks that DOS refuses even to touch.

I tried NDD on a floppy disk

whose directory had been thoroughly destroyed. Although the filenames were lost, NDD managed to restore an executable program file and two text files. This is a vastly more impressive achievement than anything possible with any other disk recovery programs.

The NDD can't repair physical damage, but it can tell you what the damage is and what to do to fix it. A 150-page trouble-

Norton's other major additions include a flexible format program that can help recover data by reformatting a disk while leaving the data intact. Safe Format can also perform a 2-second quick format of already formatted disks.

Another worthy addition, the Control Panel, sets keyboard rate, cursor size, screen colors, and serial ports, and it does most of the work of DOS's

"maintenance" mode that goes directly to the disk sectors. The package works with any large disk formatted under DOS 3.31 or 4.0.

The small ASK and BEEP programs from earlier versions are now combined into a full scale batch-file enhancer that lets you add delays, musical sounds, boxes, windows, colors, and smart menus to your batch files.

Norton's clever change-directory program now supports 50-line VGA screens. Text-search remains a speed demon. System Information (SI) still flatters your computer with an unrealistic speed test.

All the programs in the package can be accessed either separately or from a single menu that includes a list of options and parameters.

New versions of *PC Tools Deluxe* and *Mace Utilities* are due over the next few weeks, each with improved methods of file recovery. In the meantime, Norton's Version 4.5 is the undisputed champion at customizing healthy disks and healing damaged ones.



The Norton Disk Doctor performs an advanced CHKDSK function before attempting to repair a disk.

shooting manual included in the package is the most detailed guide ever written on restoring lost data. (But keep watching for the forthcoming *Paul Mace Guide to Data Recovery* for additional and alternative solutions.)

Like any program that tries to sort out scrambled data, the NDD isn't perfect, and it works best when run from an absolutely clean DOS. If you run it with a disk cache in your system, you may be told that you entered the wrong disk parameters in your setup. If you have a clone other than a Compaq, don't follow the on-screen advice to consult the list of drive tables in the troubleshooting guide, or you may clobber your disk in an attempt to fix something that isn't broken. You should call in the NDD only when you're sure something's seriously wrong.

cryptic MODE command.

Few users will require a utility to recover from an accidental format, but it's worth putting this gem on your disk anyway. The data file created by the utility is used by Norton's unerase programs to guarantee full recovery of deleted files, even when the files were badly fragmented.

An improved defragmenter lets you specify directories or files to put at the front of the disk. You can also defragment files without taking time to pack the whole disk.

The main Norton utility program for sector editing and file recovery is now easier to navigate but is otherwise the same as in Version 4.0. It refused to work with the directory structure of a disk with 725 directories, but it handles that and any other disk in its non-DOS

PC FACT FILE

The Norton Utilities Advanced Edition, Version 4.5

Peter Norton Computing
100 Wilshire Blvd.

Santa Monica, CA 90403

(800) 365-1010

(213) 319-2000

List Price: \$150 (Standard Edition, \$100).

Requires: 256K RAM, DOS 2.0 or later.

In Short: The most powerful disk repair program available, plus a dozen other valuable DOS utilities. Not copy protected.

Circle 484 on Reader Service Card



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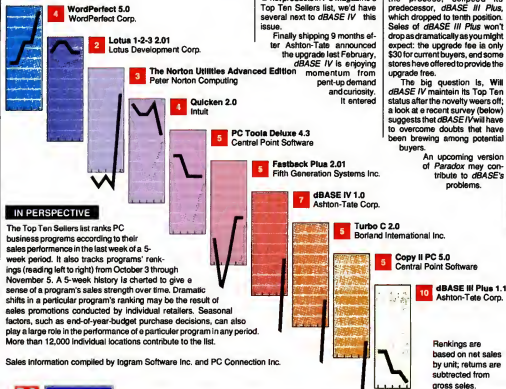
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PC MAGNET SURVEY

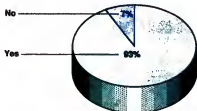
dBASE has been the PC database daddy for so long that about a year ago nothing seemed capable of surpassing it. Whether it's the long delay in delivering the upgrade or the disappointment users felt when they read what was planned for the new version, doubts have set in among database users.

Our survey of PC MagNet callers showed a slight softening of confidence in *dBASE* for the future and a strong interest in alternatives.

The doubts may be overcome when the performance of *dBASE IV* is established; see page 33 for a Hands-On report. But if users feel disappointed, they won't need much convincing before they switch.

The survey was conducted in early October and reached 590 callers to PC MagNet.

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Two Low-Cost Ways to Squeeze PostScript from Any Printer

PC HANDS ON

BY EDWARD MENDELSON

If you want the versatility afforded by PostScript output, you've got a few choices. You can spend \$4,000-plus for a PostScript laser printer, about the same for a laser printer with a hardware PostScript add-on, or less than \$500 for a software translator.

Freedom of Press, a \$495 translator from Custom Applications, includes fonts corresponding to all 35 you'd get with the Apple LaserWriter Plus. *GoScript*, LaserGo's ingenious \$195 translator, provides the 13 fonts of the original LaserWriter. The forthcoming *GoScript Plus* will offer all 35 fonts at about twice the price.

To use these translators, you tell your applications to use their PostScript printer driver, but you print all documents and graphics to disk files rather than to the printer. You then use the

translator to print the disk file.

Freedom of Press prints complex PostScript graphics and any PostScript text files. It works with virtually every 24-pin dot matrix and every non-PostScript laser printer, and with ink jets like the HP DeskJet. Copies sold after early 1989 will add color PostScript for the HP PaintJet and 24-pin dot matrix printers with color kits; a \$45 upgrade will add color printing to existing copies.

GoScript works with fewer printers but supports all major dot matrix and laser printers. You can also use the PaintJet, but with only one color on each print job. *GoScript* handles any PostScript text file but gags on large images that are no problem for *Freedom of Press*.

Both programs let you use third-party soft fonts, but you can't use Adobe's downloadable fonts because of Adobe's proprietary scaling techniques.

Translators are cheaper than printers, but time is mon-

ey—and translators are slow. A typical PostScript file that takes 2 minutes to print with a QMS JetScript board connected to a LaserJet II will take at least 6 minutes with *GoScript* and at least 8 with *Freedom of Press*.

GoScript lets you save time on later print runs by optionally saving the font cache to disk after generating fonts in memory. *Freedom of Press* comes with batch files designed for hands-off printing, and you can create similar files for *GoScript*.

Although *Freedom of Press* is the slower translator, its sophisticated font-scaling technique (licensed from Conographics) produces more-legible type at very small sizes. In ordinary text sizes, type quality is about equal, and each program produces slightly darker and denser type than Adobe's.

GoScript has the advantage in speed and price. *Freedom of Press* has more fonts and better compatibility. A PostScript laser printer is best of all.

PC FACT FILE

Freedom of Press
Custom Applications Inc.
5 Middlesex Technology Center
900 Middlesex Tpke.
Billerica, MA 01821
(508) 667-8585
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Requires: 535K RAM, 512K EMS memory, 4MB hard disk space, DOS 2.1 or later; numeric coprocessor recommended for use with graphics. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

GoScript
LaserGo Inc.
9235 Trade Pl., Suite A
San Diego, CA 92126
(800) 451-0088
(619) 530-2400
List Price: \$195
Requires: 640K RAM, 1MB hard disk space (1 MB or more EMS memory recommended), DOS 3.0 or later. Not copy protected.

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Manes's Complete MCI Mail Handbook

PC BOOK REVIEW

BY MARY KATHLEEN FLYNN

If you think 500 pages on MCI Mail sounds like too much, think again. *The Complete MCI Mail Handbook*, written by PC Magazine contributing editor

Stephen Manes, is filled with useful information and helpful tips not found in the two skinny manuals MCI Communications sends its e-mail customers.

If you're a novice to electronic mail, this book will teach you truly everything you need to know in order to use MCI Mail—including the ins and outs of modems, tel-

ex transmissions, and bulletin boards. Manes walks the reader through the e-mail service, offering undocumented shortcuts and advice on how to cut costs along the way. At each point, he shows you what MCI Mail's screen will look like and explains the various ways you can respond.



But *The Complete MCI Mail Handbook* isn't only for the uninitiated. In the later chapters, such as "Corresponding with Other E-mail Services," "Using Lotus Express," and "Information from Dow Jones," you'll find instructions on advanced applications. I found particularly helpful the

chapters on private lists, shared lists, and scripts.

An especially useful item is the Quick Reference Guide—a tear-out card that defines MCI Mail functions and terms. Four appendices list information such as access numbers and addresses of companies that produce MCI Mail services and products. An 11-page index also helps make the book a good reference tool.

For both beginners and advanced users, the \$22.95 tome is a valuable—and entertaining—resource. The book is littered with anecdotes, witty asides, and literary examples. Thankfully, Manes uses down-to-earth terms.

MCI Communications is backing Manes' book. The company even lent him chairman William G. McGowan to

write the foreword. And it's possible to order the book online. If you're already an MCI Mail customer, just enter CREATE USING at the command prompt. Then type BOOK ORDER in the script name field and be prepared to enter your credit card number.

PC FACT FILE

The Complete MCI Mail Handbook
By Stephen Manes
Bantam Books
666 Fifth Ave.
New York, NY 10013
(212) 765-6500
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AT-Compatible Adapter Emulates 8514/A

PC HANDS ON

BY WINN L. ROSCH

Among the first display adapters claiming compatibility with IBM's 8514/A, Enertronics Research's Aurora 1024 promises much more—more speed and more compatibility. While other video boards produce the same 256-color, 1,024-by-768-pixel interlaced resolution as does the 8514/A, the Aurora 1024 also emulates IBM's Application Interface, the software hooks that link graphics applications to the 8514/A standard.

Compared with the IBM original, the \$1,395 Enertronics board is quicker, earning its greater speed with a dedicated 32-bit video coprocessor operating at 40 MHz, coupled to 1MB of 150-nanosecond VRAM chips. Moreover, while the 8514/A operates only in conjunction with VGA circuitry, the Aurora 1024 runs by itself, in conjunction with a VGA board, or with MDA, CGA, and EGA display adapters.

The Aurora 1024 plugs into

both IBM's 8514 monitor and most multisynchronizing analog monitors through a female 15-pin high-density D-shell connector on its retaining bracket. At the top of the Aurora 1024, a VGA feature connector links the Aurora to the VGA board with which it might cohabit. The full-length, AT-height Aurora 1024 plugs into an 8-bit PC-bus connector. While an 8-bit connection might seem contrary to the high-performance design of the Aurora 1024—most of today's speediest video adapters use a 16-bit interface—its effect should be minimal. Rather than moving large blocks of data, the 8514/A standard uses high-level commands that shift the limit on performance from the bus to the coprocessor.

As with the IBM 8514/A, the Aurora 1024 requires that its Application Interface software be downloaded from the host system each time it is booted up. When the board is used as the only video adapter in a system, it must also have its BIOS for text displays downloaded from

disk. As a result, the Aurora 1024 produces no images until AUTOEKEC.BAT has run, and you may not be able to see on-screen diagnostic messages.

The Aurora 1024 proved itself hardware-compatible with neither the 8514/A nor the IBM VGA system. For example, the evaluation board was unable to properly sense and adapt to an 8513 display attached to it. Nor was it able to correctly modify its palette registers through hardware commands. It also defaulted on boot-up to 1,024 by 768 video while the 8514/A defaults to VGA.

Software compatibility was another matter. Once the Enertronics Application Interface emulator was loaded, the Aurora was able to mimic the 8514/A display adapter on even IBM's own applications and demonstration software. All aspects of its images matched those produced by the 8514/A on all software with which it was tested.

Precise speed comparisons between the Aurora and 8514/A are impossible because they operate in different environments.

PC FACT FILE
Aurora 1024

Enertronics Research Inc.
5 Station Plaza
1910 Pine St.
St. Louis, MO 63103
(314) 421-2771

List Price: \$1,395

Requires: IBM 8514 or analog multisynchronizing monitor.

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However, using a 16-MHz Model 80 and an 80386-based PC-compatible operating at the same speed, AutoCAD image drawing times showed the Aurora to have an edge.

While the Aurora 1024 does not deliver complete compatibility with the 8514/A, it does bring the ability to run software written for IBM's Application Interface to the PC bus. If you want 1,024 by 768 resolution at a moderate cost, the Aurora 1024 is worth looking into.

Fast Access to 120 Computer Periodicals

BY GUS VENDITTO

Medical science has yet to find a cure for information overload, but Ziff Communications (the parent company of PC Magazine) has developed *Computer Library*, a compact disk with hundreds of megabytes of facts on computers and a fast, easy-to-use search engine that bores through the mountains of articles published in the last year.

Abstracts from over 120 publications are here, including BYTE, InCider, and Publish!, as well as more-esoteric journals like CAD/CAM International, and International Robotics Today. Thirteen IEEE periodicals are summarized.

The full text of ten publications, such as PC Magazine, PC Tech Journal, and MacUser, are included, with the programs



and utilities from PC Magazine and PC Tech Journal.

Queries take from 5 to 10 seconds and produce a list of titles that can be browsed, printed,

or saved to a file.

The first editions lacked fact files and features tables for PC Magazine articles. Ziff says the fact files are coming but many

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ancillary materials, like benchmark-test charts, will never make this text-based system.

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Forms Creator Runs WYSIWYG Display

PC HANDS ON

BY JENNIFER ZAINO

Running under the GEM environment, Delrina Technology's *Per:FORM* lets you design and fill in your business forms with the help of a WYSIWYG display. You also get plenty of input/output-device support.

The \$259.95 program, which includes GEM, is divided into two modules, Design and Fill. In the Design module, you build your form using lines, rectangles, rounded boxes, textframes, and "combs." Simply put, textframes hold text, and combs are like textframes that can be automatically divided into multiple areas, particularly helpful for creating row and column cells.

While you can enter "regular" text—form titles, column headings, and so forth—directly into textframe or comb fields, you can also designate them to accept "fill" text—characters to be entered in the Form Fill module.

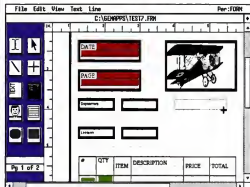
The program allows a great deal of control over text attributes. You can define characters to be underlined, italicized, or boldfaced, and predefined sizes range from 6 to 36 points.

Per:FORM makes it simple to create documents, which can be as long as 99 pages, to be filled in by your coworkers. You can determine the order in which data is entered, define compulsory fields, and make use of a number of data validation features, such as numbers-only fields and allowable value ranges. Mathematical and Boolean operations can be performed among both comb and noncomb fields. You can also assign different colors to distinguish each field and create help screens that pop up at the touch

of the F1 key.

Thanks to the graphic environment, you can import images stored in .TIF, .IMG, .PNT, and .PCX formats into the Design module. This makes it possible to import scanned images of preprinted documents and trace over them using *Per:FORM*'s tools, reducing the time it takes to regenerate the form.

Entering data in Form Fill mode is easy, though you'll want to turn the automatic recall feature off whenever possible to avoid moving along at the



Per:FORM lets you import graphic images into your forms. You can differentiate between text fields by specifying different colors for each field.

PC FACT FILE

Per:FORM

Delrina Technology Inc.
10 Bremcliffe Rd., #210
Toronto, Ontario M4G 3Y2
Canada

(416) 423-0456

List Price: \$259.95

Requires: 640K RAM, DOS
2.1 or later. Not copy protected.

CIRCLE 444 ON READER SERVICE CARD

speed of a slug.

The Form Fill mode has fewer error-trapping capabilities than I would like. For instance, alpha characters typed into a field set to accept only numbers are automatically, and without warning, changed to 0. More frustration came in the form of occasional system freeze-ups and load failures.

Per:FORM provides capabilities not available in most other forms packages, most notably graphic import and a WYSIWYG display. Obviously, confirmed GEM users should feel particularly comfortable with it. While others may hesitate to hop on the GEM bandwagon, *Per:FORM*'s impressive range of options may make the ride worthwhile.

A Versatile 5 1/4-Inch Disk Drive for PS/2s

PC HANDS ON

BY WINN L. ROSCH

The seemingly trivial matter of adding a 5 1/4-inch floppy disk drive to IBM PS/2s has daunted many an unsuspecting IBM buyer over the last year and a half. For what seemed to many like ages, the only choice was an oversized IBM drive.

Dolphin Systems Technology isn't the first to offer an alternative drive, but its Matchmate 360 arrives among the more intelligent ones you'll find.

By necessity, the Matchmate 360 is an external unit—the half-height, 5 1/4-inch, 360K Chinon drive won't fit the small

PS/2 floppy disk bays. (A high-density model, the Matchmate 1200, is also available.)

The \$349 system links to its host PS/2 by inserting a small adapter card between the system's internal floppy disk drives and the planar board (on Models 25, 30, 60, and 80) or by plugging into the B: drive disk connector (Models 50 and 70).

A ribbon cable carries the signals to the back of the PS/2, and a 6-foot-long, standard cable extends to the external drive. The generous length allows you a great deal of flexibility in locating the 2 1/2- by 5 1/2- by 1 1/4-inch (HWD) drive, which is small enough to sit atop a Model 60 or 80 tower.

But the Matchmate's real forte is the flexibility it allows. The Matchmate system leaves your PS/2 drives alone until you slide a switch located on the external drive. The external unit then takes over the B: drive designation, deactivating your internal B: drive if you have one. Note that putting the adapter in the drive slot in the Model 50 and 70 precludes use of an internal B: drive.

You can daisy-chain additional Dolphin drives or a tape backup unit. The system—and any daisy-chained drives—draws all of its power from the host.

My only complaint with this system regards the select

PC FACT FILE

Matchmate 360

Dolphin Systems Technology
603-B E. Alton Ave.
Santa Ana, CA 92705
(714) 558-3220

List Price: \$349

Requires: IBM PS/2.

CIRCLE 445 ON READER SERVICE CARD

switch, which hides on the rear panel among the cable connectors. A vital switch like this should be up front and lit to show the status of the drive.

The Matchmate 360 is an excellent choice if you need to add a 5 1/4-inch floppy disk drive to your PS/2.

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**EDITOR'S
CHOICE**
September 1987

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Memory expansion of up to 16MB of 32 Bit RAM. Includes socket for Weitek, 80387, or 80287 math Co-processors.

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- 101 Enhanced Keyboard
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- 1.2MB Floppy Disk Drive
- AT and OS/2 Compatibility
- 220 Watt Power Supply
- Socket for an 80287
- Socket for an 80387
- Accepts Weitek 1187 Chip set
- Tower Case Available (add \$225.00)
- One 32 Bit, Five 16 Bit and Two 8 Bit Slots
- Landmark speed test equals 33.6
- Norton SI rating equals 31.6
- Large selection of Hard Disks available from 20 to 320MB in ESDI, SCSI, RLL and MFM drive configurations.

NEW

20MHz **\$2,295** **386-9**

Up to 16MB of 32 Bit RAM. Sockets for Weitek, 80387 and 80287 on board.

- 80386 Running at 16/20MHz and 0 Watt State
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- One 32 Bit Slot, Five 16 Bit Slots, Two 8 Bit Slots
- Norton SI rating equals 27
- Western Digital 2F-2H Controller
- 1.2MB Floppy Disk Drive
- AT and OS/2 Compatibility
- 220 Watt Power Supply
- Socket for Weitek, 80387 and 80287
- One 32 Bit Slot, Five 16 Bit Slots, Two 8 Bit Slots
- Norton SI rating equals 27

Model 286-1 12MHz

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- 80286 Running at 12MHz, 0 Watt State
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- 101 Enhanced Keyboard
- Western Digital 2F-2H Controller
- 1.2MB Floppy Disk Drive
- AT and OS/2 Compatibility
- 220 Watt Power Supply
- Socket for 80287 Coprocessor

Model 286-2
16MHz

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Accepts Compaq memory boards

- 80386 Running at 16MHz and 0 Watt State
- 1MB of Static Column Ram
- Speed selectable for 4.77MHz/16MHz
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- 101 Enhanced Keyboard
- Western Digital 2F-2H Controller
- 1.2MB Floppy Disk Drive
- AT and OS/2 Compatibility
- 220 Watt Power Supply
- Socket for 80287 (daughter card for 80287)
- One 32 Bit Slot, Five 16 Bit Slots, Two 8 Bit Slots
- Norton SI rating equals 20.5

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NEW ON THE MARKET

by Lori Grunin

LaserJet Add-in Board Provides Transparent Print Spooling for Four Users

Extended Systems expands its line of LaserJet Series II and IID enhancements with the ES1-2041B ShareSpool, an add-in board that allows up to four users to share a single printer.

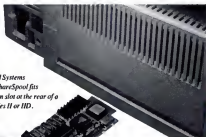
The ShareSpool fits into the printer's I/O option slot and requires no special software for installation or operation. Users connect their PCs to the spooler

via an RJ-45 modular jack and cable, which accepts data transmitted at 9,600 or 19,200 bits per second.

The 256K buffer holds the equivalent of roughly 150 pages of text, according to Extended Systems. An optional 1MB upgrade is available for \$750.

List Price: ES1-2041B ShareSpool, \$495. **Requires:** Hewlett-Packard LaserJet II or IID. Extended Systems, 6062 Morris Hill Ln., Boise, Idaho 83704; (208) 322-7163.

CIRCLE 442 ON READER SERVICE CARD



The Extended Systems ES1-2041B ShareSpool fits into the option slot at the rear of a LaserJet Series II or IID.

PORT Lite: Downsized LANs, Full-Sized Functionality

PORT Lite, a LAN operating system from Waterloo Microsystems, offers LANs with five or fewer stations a \$495 alternative to a full-fledged network operating system.

PORT Lite runs on PS/2s and PCs in an ARCnet or Token-Ring Network and doesn't require a proprietary or a dedicated server. Each workstation on the LAN can share its disk drive and printer with the others up to a maximum of five drives and 15 printers. Users can choose between command-line and icon-driven interfaces.

The software supports DOS 3.x record and file locking, protected-mode operation, and extended memory. PC-XT users can purchase a VRAM Card in

512K (\$695) or 1MB (\$995) versions, which enables PORT Lite to run entirely in virtual memory.

The package provides protection against power failures—a temporary outage at the server does not result in data loss or a need for the rest of the stations to reboot, according to Waterloo.

When you've outgrown PORT Lite, Waterloo will provide an upgrade to its PORT PC LAN for \$2,000.

List Price: PORT Lite, \$495; 512K VRAM card, \$695; 1MB VRAM card, \$995; upgrade to PORT PC LAN, \$2,000. **Requires:** 640K RAM, DOS 3.0 or later. Not copy protected. Waterloo Microsystems, 3597 Parkway Ln., #200, Norcross, GA 30092; (404) 441-9252.

CIRCLE 440 ON READER SERVICE CARD

Pop-up Graphs, Easy Stats From New England Software

Since today's business requires more quantitative analysis than ever, New England Software has come to the aid of users with two software packages that help uncover the jealously guarded secrets of their data.

Graph-in-the-Box Analytic lets you construct 16 types of graphs based on x-y and double-y plotting. The \$199.95 program provides high-low-close graphs, error-bars, trend lines, and curve fitting. Results can be viewed with either linear or logarithmic scaling.

The program operates both as a standalone and a memory-resident application and is capable of capturing data from another application and displaying a graph on-screen. It also includes a calculation utility for manipulating data.

For number crunching, *GB-STAT* provides over 300 statistical procedures. In addition to calculating basic statistics, the menu-driven program performs ANOVA; multiple, linear, and polynomial regressions; reliability, factor, and discriminant analyses; and time series procedures.

The program can import data in PRN, .DIF, or ASCII format and has the graphing capabilities

(continues on page 52)

HOT PROSPECT

Plus Impulse Offers Higher Disk Throughput, Up to 2.6 Gigabytes of Storage

Plus Development Corp. answers the cries of users of LAN and disk-intensive applications with Plus Impulse, 40MB (\$895) and 80MB (\$1,279) hard disks boasting a 12-millisecond effective access time. Up to 32 drives can be connected to 2.6 gigabytes of storage.

Impulse's speedy access is made possible by Plus's new, proprietary Cluster Disk Interface and DisCache architecture, according to Plus. The CDI attains a data transfer rate of up to 4MB per second, compared with SCSI's peak of 1MB. DisCache, a 64K static RAM cache on each drive, further reduces transfer time. In tandem with the

drive's on-board controller, the cache lets multiple drives operate simultaneously.

One 16-bit adapter (\$100 extra) supports 16 drives. One machine can handle up to 24 drives on two adapters; with Novell's NetWare, 32 drives yield 2.6 gigabytes of storage.

List Price: Plus Impulse, 40MB, \$895; 80MB, \$1,279; adapter card and software, \$100. **Requires:** 80286- or 80386-compatible machine, DOS 3.0 or later. Plus Development Corp., 1778 McCarthy Blvd., Milpitas, CA 95035; (408) 434-6900.

CIRCLE 436 ON READER SERVICE CARD



The 40MB and 80MB Plus Impulse drives feature a 64K static RAM cache and Cluster Disk Interface.

NEW ON THE MARKET

Pop-up Graphs

(continued from page 51)

ties of both *Graph-in-the-Box* programs.

List Price: *Graph-in-the-Box Analytic*, \$199.95; *GB-STAT*, \$299.95. **Requires:** *Graph-in-the-Box Analytic*: 256K RAM, CGA- or Hercules-compatible graphics

adapter, DOS 2.0 or later. *GB-STAT*: 512K RAM, CGA- or Hercules-compatible graphics adapter, DOS 2.0 or later. Not copy protected. New England Software, Greenwich Office Park, #3, Greenwich, CT 06831; (203) 625-0062.

CIRCLE 430 ON READER SERVICE CARD

Three 16-Level Gray-Scale Scanners from The Complete PC

If you want to incorporate images with 16 levels of gray into your documents, but your bank account dictates otherwise, three scanners from *The Complete PC* might economically fill your needs.

you scan and edit images larger than available RAM.

The menu-driven package allows users to rotate images 90, 180, or 270 degrees; scale images from 10 to 200 percent of original size; crop and erase



The \$249 Complete Hand Scanner/400 scans images at 200, 300, or 400 dots per inch.

The \$899 Complete Page Scanner scans sheet-fed images up to 8 inches wide and 14 inches long at a user-selectable 200 or 300 dots per inch. For \$299, The Complete Half-Page Scanner can cover a 4- by 14-inch image at a resolution of 200 dpi.

Replacing the company's 200-dpi hand scanner, The Complete Hand Scanner/400 allows images 2½ inches wide and 14 inches long to be scanned at 200, 300, or 400 dpi.

All three simulate 16 levels of gray with three dithering patterns. They also come with *SmartScan*, software that allows viewing of an image as it is scanned and is capable of letting

images; pixel edit; perform page layout; and merge images. *SmartScan* will edit images in .PCX, .MSP, .CUT, ASCII, and Epson FX graphics formats and convert them to TIFF and .IMG formats as well.

List Price: The Complete Page Scanner, \$899; The Complete Half-Page Scanner, \$299; The Complete Hand Scanner/400, \$249.

Requires: 512K RAM (640K recommended), hard disk, CGA- or Hercules-compatible graphics adapter, DOS 2.1 or later. The Complete PC, 521 Cottonwood Dr., Milpitas, CA 95035; (408) 434-0145.

CIRCLE 437 ON READER SERVICE CARD

\$79 Utility Lets Your PostScript Printer Print Non-PostScript Files

Until now, users who needed PostScript-quality output and laser printer flexibility have been deterred by the inability of PostScript printers to handle files from many popular applications. *Trading Post*, a RAM-resident utility from *LaserTools Corp.*, can change that for \$79.

Users can configure up to eight virtual ports—four parallel and four serial—with custom instructions. *Trading Post* translates non-PostScript files from programs such as *Lotus 1-2-3* or *dBASE III* when output

is directed to a given port.

For text printers, the utility allows manipulation of fonts, orientation, page size, paper size, bins, and number of pages. *Trading Post* supports multiple printers, printer-sharing devices, and common networks, according to *LaserTools*.

List Price: *Trading Post*, \$79. **Requires:** 7K RAM, DOS 2.0 or later. Not copy protected. *LaserTools Corp.*, 3025 Buena Vista Way, Berkeley, CA 94708; (415) 843-2234.

CIRCLE 438 ON READER SERVICE CARD

Wang Freestyle Electronic Desktop Accepts Voice, Handwritten Input

Wang Laboratories sustains the dream of the paperless office with *Freestyle*, an icon-based simulated desktop that accepts voice and handwritten annotations. The contents of the desktop can be sent to other *Freestyle*-equipped coworkers, or faxed, minus voice notes, by any Group III fax machine.

Documents can be scanned with the \$2,550 Wang SC300 scanner or screen-captured onto the desktop. Once there, they

can be annotated and manipulated with the electronic pencil and tablet. An optional voice board and handset allows users to attach spoken comments to pages; voice annotation features include pause and fast forward.

Freestyle runs in the background until it is summoned by touching the pencil to the tablet. By dragging icons with the pencil, *Freestyle*'s pages can be selectively grouped, copied, faxed, or printed.

The \$1,995 setup includes the tablet and pencil, interface card, and software. The voice interface card, handset, and software costs \$1,495 extra.

List Price: Wang *Freestyle*, base configuration, \$1,995; voice interface, \$1,495; Wang SC300 scanner, \$2,550. **Requires:** 80286-based PC, 512K RAM, hard disk drive, graphics adapter, DOS 3.3 or later. Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; (508) 459-5000.

CIRCLE 441 ON READER SERVICE CARD



Wang *Freestyle* users can attach handwritten notes to their pages on the simulated desktop with the electronic pencil and tablet.

FAST MICRO

ORDER LINE:

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WordPerfect 5.0



\$215
List \$495

The most popular word processor is now even better than ever! Version 5.0 adds multiple font support, graphics integration, page preview and much more. WordPerfect 5.0 still retains its feel and ease of use that made it #1. Combine this with the best support in the industry and you can't lose.

SPECIALS

TOSHIBA T1000 \$749

The Toshiba T1000 is the perfect second PC! It comes with 512K of ram, a 720K floppy drive, a superbly LCD screen and MS-DOS in rom! All this in a battery-powered 7 pound package. A 768K ram card is just \$269 and can be set as base, expanded, or a non-volatile ram disk.



TOSHIBA Printers

These 24 pin models are loaded with features and are priced right.

You can select multiple fonts and pitches right from the menu-driven front control panel. With paper parking, you can insert a single sheet without removing the continuous form paper. All this and multiple emulations with no dip switches.

P321SL Narrow P341SL Wide

\$459 \$629



HARDWARE

PRINTERS

ALPS	LIST	FAST
Allegro 24	499	315
Citizen		
120D	229	145
190D	259	165
MSP40	449	299
Tribute 124	599	429
Tribute 224	999	599
Diamond		
150P	499	299
Epson		
Fujitsu		
OK3400	995	549
NEC		
P2200	569	339
P5200	799	509
P5300	1049	669
LC800	4799	Call
Okidata		
192 Plus	319	219
320	499	329
390	699	469
393 (Risc Interface)	1399	915
Panasonic		
KCP1080-2	299	159
KCP1091-2	329	195
KCP1124	529	315
KCP1585	749	419
KCP1524	949	519
Star		
NX1000	289	169
NX2400	499	319
NB2410	999	449
Toshiba		
P321SL	749	459
P341SL	999	629
P351SX	1499	929

BOARDS

AST	LIST	FAST
Hot Shot 286	645	339
Six Pak Plus 64K	210	119
DTK		
286 10mhz M/B	499	249
XT 1.2mb FDC	79	45
Genos		
1200B Int Modem	149	69
2400B Int Modem	249	129
Everex		
Super EGA Hi-Res+	399	169
Super VGA #5100	445	239
Super VGA Hi-Res #5200	645	359
Hercules		
Card	299	169
Intel		
8087-2	250	149
80287-10	480	249
Above Board Plus	795	459
Orchid		
Designer VGA	545	309
Tiny Turbo 286	445	299
Paradise Turbo 12mhz	645	359
Twain		
Autowatch 480	349	199
VGA Plus	399	259
VGA Plus 16	499	299
VGA Professional	799	499
Practical Peripherals		
1200B Int Modem	199	65
2400B Int Modem	199	149
Prometheus		
Promodem 2400B	199	129
Promodem 2400G	249	159

The Complete PC	LIST	FAST
Answering Machine	349	219
Fax	399	249
Hand Scanner	249	159
USRobotics		
1200 Baud Internal	149	89
1200 Baud External	179	119
2400 Baud Internal	249	149
2400 Baud External	279	169
Video 7		
Fast Write VGA	549	335
Vega Deluxe	379	189
Vega VGA	499	259
V-RAM VGA	999	Call

LAPTOPS

Mitsubishi	LIST	FAST
MP-286L Dual	3195	1879
MP-286L 20mb	4595	2449
NEC		
Multispeed EL II	2295	1449
Multispeed HD	3695	2249
Toshiba		
T1000	1249	749
T1200F	2099	1299
T1200FB Backlit	2399	1499
T1200HB Backlit	3599	2399
T1600	5799	3695
T3200	7499	4595
TS100		
Zenith		
SuperSport Dual	2399	1599
SuperSport 20mb	2399	2399
SuperSport 286 20mb	4999	3295

CALL FOR LAPTOP SPECIALS

MONITORS

Magnavox	LIST	FAST
73M749 VGA	229	149
9CM092 VGA	649	419
Mitsubishi		
1409 RGB	399	259
1410 EGA	599	399
Diamond Scan 1381	799	489
NEC		
Multisync II	899	575
Multisync Plus	1399	869
Pricenton		
Max15	389	Call
Ultrazync	849	779
Ultra 16	1375	859
Sekio CM1430	995	599
Sony		
1302 Multiscan	995	659
1303 Multiscan	825	479
Zenith 1490	999	599

DISK DRIVES

Miniscrbe	LIST	FAST
40MB AT #3650	499	319
Mitsubishi		
40MB AT MHS35 22ms	625	399
Seagate		
XT XT #225	599	267
30MB XT #238	699	287
40MB AT #251	899	349
Call		
40MB AT #251-1	999	449
80MB AT #4096	1199	549
Toshiba		
360K Floppy	119	77
720K 3.5" Floppy	149	87
1.2MB 5.25" Floppy	149	97
1.44MB 3.5" Floppy	169	100

Call On Non-Listed Items

SOFTWARE

Database

Clipper	LIST	FAST
Acct.	899	Call
Database	900	379
dBase IV	795	449
dBase Diamond	199	105
Fontbase Plus	395	185
Paradox	725	399
Quartz	755	449
RapidFile	295	179
Rbase for DOS	700	419
Reflex	349	84
Q & A	159	79
Desktop Publishing		
Byline	175	175
GEM Desktop Pub.	299	169
Penmaker 3.0	99	Call
PFS First Publisher	129	89
Publisher's Pamphlet	285	149
Venture 2.0	995	459
Financial		
Bedford Integr. Acct.	249	149
BPI		
Computer Associates		
DAC 3.0	99	59
DAC Payroll 3.0	99	59
Dollars & Sense	179	99
In-House Accountant	199	109
Managing Your Money	199	117
Peachtree Complete II	199	149

Graphics

Deluxe Paint II	LIST	FAST
Draw Applause	105	67
First Graphics	129	99
Freeance Plus	495	Call
GEM Draw Plus	299	165
GEM CAD	99	49
Graph Plus	495	299
Harvard Graphics	495	Call
Perspective Jr.	495	Call
Integrated		
First Choice	159	95
Logitech HiRes Bus	149	79
Windows 286	99	59
Windows 386	195	117

Micro

Logitech C7 Serial/Bus	119	69
Logitech HiRes/Bus	150	79
Microsoft Serial/Bus	150	99
Microsoft W/ Windows	200	129
PC Mouse II Serial/Bus	149	92
Power Protection		
Curtis Ruby Plus	115	59
Datashield 85	90	50
Datashield 100	99	57
Isobar 4-6	90	42

Programming

Macro Assembler	LIST	FAST
Norton Guides (Speedy)	100	58
Turbo Basic	99	58
Turbo C 2.0	149	90
Turbo Pascal 5.0	149	90
Quick Basic	99	59
Quick C	99	59
Spreadsheet		
Excel	495	Call
Lotus	495	Call
Lucid 3-D	149	79
Quattro	249	149
Worksheet Utilities	100	55
Utilities		
Corefast	149	97
Desklink	170	95
Designview	130	73
Fastback Plus	199	99
FastTrax	50	33
Formtool	50	33
Laplink Plus	140	77
Norton Advanced	149	74
PC Tools Deluxe	90	36
Sidewalk Plus	195	119
XTree	70	34

Word Processors

Easy Extra	LIST	FAST
GEM First Word Plus	199	117
Gemmalk III	89	49
Manuscript	495	Call
Multimate Adv. II	565	247
Professional Write	195	105
Rhymester	95	49
Sprint	195	119
Q & A Write	199	119
Webster's Writer	60	47
Word	450	Call
Word Perfect	495	Call
Word Perfect Library	129	59
WordStar Prof. 5.0	499	219
XyWrite II Plus	445	299

Call On Non-Listed Items

TERMS: Most Orders Ship Within 48 hours. No Charge for Visa or MasterCard. Shipping Charge: 18¢ (VISA, SA). Product warranties, offers & claims are handled by the manufacturers. All returns are subject to 15% restocking fee. Call for R.A. number. No returns on used items. Sorry, no COD's. Personal/Company checks delay shipping. Compatibility not guaranteed. APT's add \$15. Price/availability subject to change. AD orders add 6-7% tax. To use protection, we check for stolen credit cards. Mailing Address: 3721 E. Grove St., Phoenix, AZ 85046. To place orders only call 800-441-3378. To check on an order call 602-471-4973.

Connect Worksheets with Look & Link

PC HANDS ON

BY CRAIG STINSON

If you've been hankering for the ability to link Lotus 1-2-3 worksheets, but you're tired of waiting for Release 3, you might want to check out Personics' *Look & Link*. This elegant pair of add-ins makes available to Release 2 users a substantial chunk of the power that may someday yet materialize in 1-2-3, Release 3.

The Look portion of the package lets you browse a second worksheet while working in a first. The second sheet pops up in a "browse window" in the lower-right corner of the screen.

The browse window is just that—a read-only peephole into any worksheet on-disk. You can stroll about, but you can't change anything.

You can, however, cut and paste data directly from the browse window into your main worksheet. Look's Combine command has four options: Formulas, Values, Add, and Subtract. Add and Subtract work just like their counterparts on the 1-2-3 /Formula Combine menu. Formulas and Values together provide the functionality of 1-2-3's /File Combine Copy.

PC (CBI) 10/11/1989 09:57
Retrieves Combine Data
Browse a Different File

	A	B	C	D	E
1	National Sales				
2	Product Line	Cash Sales	Installation Sales		
3	Applications	\$66,130,233	\$62,032,289		
4	Automation	\$11,911,545	\$4,559,946		
5	Coating and Heating	\$21,925,963	\$36,618,464		
6	Hardware				
7	Low & Garden				
8	Lighting				
9	Office				
10	Outdoor Living				
11	Pool Care				
12	Sporting Goods				
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

07-Nov-89 12:04 PM

The Look portion of Look & Link lets you browse one spreadsheet while you edit another. You can cut and paste from the "browse window."

Link allows you to establish permanent relationships between worksheets. It does this in two ways: with dependency trees and with external-reference formulas that incorporate custom @ functions.

A dependency tree is a user-specified file hierarchy designed to automate worksheet consolidation. Let's say your company has four sales divisions and you consolidate reports from these divisions on a monthly basis. When all the data is ready, just execute the Consolidate command and the consolidation is done.

Dependency trees seemingly can run to any depth or breadth. For example, you could specify an annual consolidation that rolled up four quarterly reports, each consisting of three monthlies, each of which consolidated four divisional monthlies. The tree resides in its own disk file, with the extension .TRE.

The remainder of Link's power is supplied as a set of custom @ functions. The most important of these—@wkscell, @wkssum, @wksavg, @wksmin, @wksmax, @wkslookup, and @wkslookup—allow you to write

PC FACT FILE

Look & Link

Personics Corp.
63 Great Rd.
Maynard, MA 01754
(508) 897-1575


List Price: \$99.95

Requires: 512K RAM; Lotus 1-2-3, Release 2; DOS 2.0 or later. Not copy protected.

CIRCLE 446 ON READER SERVICE CARD

formulas in one worksheet that references cells in another. The arguments for these functions can be stated as offsets within named ranges, so the functions stay current even if the target cells in the external worksheet are moved.

Look and Link together consume about 94K of conventional memory. Either can be detached for memory reclamation.

All in all, *Look & Link* is a slick way to boost the power of 1-2-3. It's probably best not to consider it a step along the way to Release 3, however; worksheets loaded with @wks functions will undoubtedly have to be modified when the "real thing" comes along. But if you're not sure you want to do the big upgrade anyway, this add-in is worth a look. 

Micro Practidisk: An Easy Way to Add Floppy Disk Drives to Your System

PC HANDS ON

BY WINN L. ROSCH

Practical Computer Technologies gives you the option of adding either external or internal 3½-inch floppy disk drives to your PC, XT, or AT. Its magic is a special floppy disk controller, dubbed the Micro Practidisk, that resides in tandem with any controller. Just slide it into your computer. Then plug in your new 3½-inch disk drive to the new controller.

At under 5 inches long, the

Practidisk card fits the shortest of short slots and any PC. A version for external drives (with an added connector on the retaining bracket) costs \$189. Complete drive-and-controller systems are also available.

The \$179 controller handles all drive formats, including high-density 1.2MB 5¼-inch and 1.44MB 3½-inch drives in PCs and XTs.

A combination of firmware built into the controller (an extension of your system BIOS) and a software driver bring the new floppy disk drive to life, as-

signing it the next available drive letter on the list.

Practical Computer claims that its controller will run a 3½-inch floppy disk under any version of DOS. I couldn't test DOS 1.1 because I couldn't find a copy, but DOS 2.1 proved to be no problem.

Throughout February, the Practidisk card will retail at the reduced rates of \$125 for an internal controller and \$135 for an external. Compared with the \$30 to \$100 mail-order prices of high-density controllers, the Practidisk system is no bargain.

PC FACT FILE

Micro Practidisk
Practical Computer
Technologies Inc.


3972 Walnut St.
Fairfax, VA 22030
(703) 385-3332

List Price: \$179 (internal);

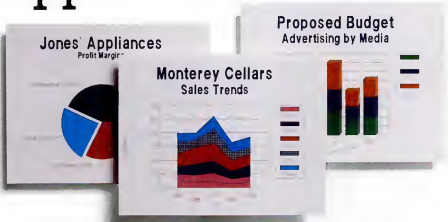
\$189 (external).

Requires: IBM PC, XT, AT, or compatible, any version of DOS.

CIRCLE 446 ON READER SERVICE CARD

Its virtues are the flexibility to handle multiple drives by working with your controller and its no-worries compatibility. 

Appearances count.



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Quattro's advanced graphics include graphs that *can't be done* by the leading spreadsheet. Quattro also includes more graph types than the best-known spreadsheet—like horizontal bar, line-bar, 3-D bar, and area charts.

Quattro's spreadsheet graphics are also completely and easily customizable. With Quattro's color at your fingertips, you can easily highlight, compare, analyze, print, present, discuss and decide.

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Because Quattro is so compatible with the Other Spreadsheet, you can switch to Quattro without having to learn a new program.

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CIRCLE 137 ON READER SERVICE CARD

\$120 UltraVision Offers Alternative to VGA

PC HANDS ON

BY LORIGRUNIN

If your EGA card, once the pride of your system, now seems as up-to-date as 8-track tapes, you may want to modernize with UltraVision. The \$119.95 hardware-and-software combination allows many EGA cards to support VGA display modes. It also gives added control over screen attributes such as color, fonts, and display size.

If you have a supported standard EGA card, UltraVision's Booster Card can increase resolution to 640 by 480 running VGA applications—assuming you've got a multiscanning monitor. Personics includes VGA drivers for some packages, including AutoCAD, MicroSoft Windows, PC Paintbrush, Ventura Publisher, Harvard Professional Graphics, and Lotus 1-2-3, but other programs must be tried on a case-by-case basis.

UltraVision will also work with EGA cards that already support 640-by-480 modes. The software doesn't add resolution but gives you more power over your display by adding screen fonts and control over screen size and colors. Possible screen sizes range from the usual 80 columns by 25 rows to 132 by 43.

Although the EGA palette holds 64 colors, it usually takes a paint program to see more than the DOS-chosen 16. UltraVision lets you display and choose among the other 48 colors. The software also lets you choose from among 17 additional screen fonts, including Script, Courier, and Old English. Settings can be changed by issuing commands at the DOS prompt or through UltraVision's menus.

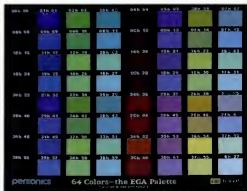
The installation instructions are detailed and well illustrated. Fortunately, the hardware manual will help you determine whether your card needs the booster and also provides the

appropriate switch and jumper settings. Configuring UltraVision to work with specific applications can be a nuisance, since you must copy the drivers man-

ually onto your hard disk.

Your biggest problem may be determining exactly how much display power you will gain from UltraVision before

you dish out your money. At its best, UltraVision is an inexpensive alternative to purchasing a VGA card. At the very least, you get a choice of 48 more colors and 17 additional screen fonts.



The Personics UltraVision puts the entire EGA 64-color palette at your command.

PC FACT FILE

UltraVision

Personics

63 Great Rd.
Maynard, MA 01754
(508) 897-1519

List Price: \$119.95

Requires: 18K RAM, supported EGA-compatible graphics card and display, DOS 2.0 or later.

CIRCLE 431 ON READER SERVICE CARD

\$55 MathCAD Applications Pack Adds Predefined Functions

PC HANDS ON

BY BARRY SIMON

MathSoft's *Advanced Math Applications Pack* adds predefined routines to MathCAD—PC Magazine Editor's Choice and two-time "Best of" winner. The \$55 *Applications Pack* supplies the few mathematical functions left out of MathCAD 2.0. The notable additions are routines to solve ordinary differential equations and compute the eigenvalues and eigenvectors of matrices.

The *Advanced Math Applications Pack* consists of 16 MathCAD worksheets. Most of the applications are general-purpose routines for which you can plug in your own variables. For example, one model computes the eigenvalues of a matrix. If you replace the given matrix with your own, Math-

CAD will compute the eigenvalues for it.

A few of the applications are specific models that illustrate what MathCAD can do. For example, one is an analysis of flow around an airfoil using conformal mapping.

The applications make clever use of the discrepancy between the line-length MathCAD's editor can support and the line-length that can fit on-screen. In the applications, the complicated formulas are tucked away—to the right of the screen, where you need not see them. If you want to look at them, you can scroll the screen to the left.

My only real complaint with the *Applications Pack* is that the functions it offers should have been integrated directly into the main MathCAD program. By ordinary standards, it isn't difficult to load these files into a

window and then cut and paste them into a model, but compared with using MathCAD's inherent functions, this process feels awkward.

PC FACT FILE

Advanced Math

Applications Pack

MathSoft Inc.

1 Kendall Sq.
Cambridge, MA 02139
(800) Math-CAD, or 628-4223
List Price: \$55

Requires: 640K RAM, MathCAD 2.x, graphics monitor, math coprocessor (optional), DOS 2.0 or later. Not copy protected.

CIRCLE 432 ON READER SERVICE CARD

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BGIDE/EMO BENCHMARK	TURBO ASSEMBLER	Microsoft® Assembler
Assembly time (seconds)	9.34	27.46
Link time (seconds)	4.15	10.51
FEATURE COMPARISON		
MASM compatible (4.0, 5.0, 5.1)	Yes	No
Thorough type checking	Yes	No
Nested structures and unions	Yes	No
Multimodule cross reference	Yes	No
Assemble multiple files	Yes	No

Runs on IBM PS/2 model 60 using Turbo Assembler version 1.0, Turbo Linker version 2.0, Microsoft Macro Assembler version 5.10, Microsoft Overlay Loader version 3.04.

- Faster than other assemblers
- MASM compatible (4.0, 5.0, and 5.1)
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- Full 386 support

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FEATURE COMPARISON	TURBO DEBUGGER	CodeView®
Multiple overlapping views	Yes	No
386 virtual-86 mode debugging	Yes	No
Remote debugging	Yes	No
Data debugging	Yes	Partial
Generalized breakpoints	Yes	No
Session logging	Yes	No
Conventional memory used—80386	Zero K	230K
Conventional memory used—remote	15K	N/A

Turbo Debugger version 1.0, Microsoft CodeView version 2.3.

DATA DEBUGGER

- Follow pointers through linked lists
- Browse through arrays and data structures
- Change data values

BREAKPOINTS

- Actions: stop, run code, log expression
- Break on condition, memory changed
- Software ICE capabilities
- 386 debug register support
- Support for hardware debuggers

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- Supports CodeView® and MAP-compatible programs

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FEATURE COMPARISON	TURBO PASCAL 5.0	Turbo Pascal 4.0
Integrated debugger	Yes	No
Overlays, including EMS support	Yes	No
8087 floating-point emulation	Yes	No
Turbo Debugger support	Yes	No
Procedural types, variables, parameters	Yes	No
Smart linking of code and data	Yes	No
Constant expressions	Yes	No
EMS support for editor	Yes	No

NEW TURBO PASCAL 5.0

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- Support for Borland's Turbo Assembler and Turbo Debugger
- Procedural types, variables and parameters
- Smaller, tighter programs: Smart Linker strips unused code and data
- Constant expressions
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FEATURE COMPARISON	TURBO C 2.0	Microsoft® C 5.1
Integrated debugger	Yes	No*
Inline assembly	Yes	No
Auto dependency checking	Yes	No
EMS support for edit buffer	Yes	No
Device-independent graphics	Yes	No
Number of memory models	6	5
Price	\$149.95	\$450.00

*Integrated debugger included with Quattro C.

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COMMUNIQUE

edited by Bill Howard

ARE YOU PREPARED FOR
LOTUS 30???We Can Do It For You!
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Based on Lotus's product schedule, you should prepare for Lotus 30 around the year 2084. Ad in the Charlotte (N.C.) Observer, September 26, 1988.

Technology News I

"NEC's million megabit chip is being made for the world market at its Livingston factory in central Scotland."

—"Locate in Scotland" ad supplement, *Forbes*, July 11, 1988

Technology News II

"Just now it is a bit of a toss-up whether to buy four 256-megabit DRAM chips or one 1-megabit chip. In the future, that won't be true. As a working rule, it will never again be cheaper to buy 256-megabit chips than it is to buy 1-megabit chips."

—Jerry Pournelle column, *InfoWorld*, October 17, 1988

Save the Children

"Heading a full line of competitively priced 386 and 286 portable and desktop computers from the company where one-day service is not a problem. Reliability is key for Micro Express products. All Micro Express PCs are burned in for at least 72 hours to eliminate infant deaths."

—Micro Express PCs ad

Pretty Warm, Too

"The Zuckerklink [is] a \$39 network that hooks two machines together at 500,000 kilowatts. That's pretty fast."

—The Ingram Journal, June 1988

E-Mail Offers Links
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Athletic Supporters

Was it electronic messages of encouragement that spurred Greg Louganis to Olympic gold in Seoul last month, or that helped the U.S. yachting team sail smoothly on Korean waters?

Could be. U.S. Olympic supporters.

The headline writer simply couldn't resist? From *PC Week*, October 3, 1988.

That Many? Wow!

"The 1 megabyte memory of the HL-8 [Brother laser printer] makes possible 300 dots-per-inch full page graphic printing without adding memory expansion boards, the 3 megabyte memory of the HL-8 can be used to download up to a lot of fonts and still product 300 dots-per-inch full page graphics!"

—Brother HL-8 brochure

Rumor Watch

"Our original sale opinion (for Compaq) was founded on four tenets: IBM (114) would recoup market share after trimming its costs to 60% of its competitors' costs; IBM shipped one million PS/2s in the product's first seven months and more than two million in its final year; competition would fuel price pressure; . . . IBM will push more clones off the shelf . . ."

—Portfolio Manager's Weekly (Donaldson, Lufkin & Jenrette), June 10, 1988

Teamwork

"Copal Dot Matrix Printer: bi-directional printing, 120 cps; 80 columns, 8" print range; tractor and friction paper feed; buffer capability of one line; parallel Centronics interface, RS232 cable included . . ."

—COMB mail-order catalog

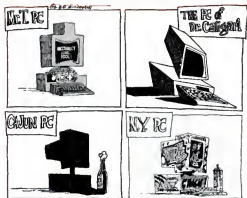
Amazing Facts

"Multitasking is something the user just can't do with OS/2 and MS-DOS," Schechter explained. "It can't be done without the Intel 386 architecture."

—Microcomputer Solutions, September/October 1988

The new AT&T service will allow a multi-site private network to transmit and receive data over the public network using only one multiplexer and a DSU CSU at the host end and a DSU CSU at each remote location. A DSU CSU (data service unit channel service unit) is a data communication device that connects a computer to a mainframe computer.

And the line quality, well, you wouldn't believe! In fact, that's how we transmitted this story. (MIS Week August 15, 1988, story on Astrocom multiplexers used on AT&T data networks)

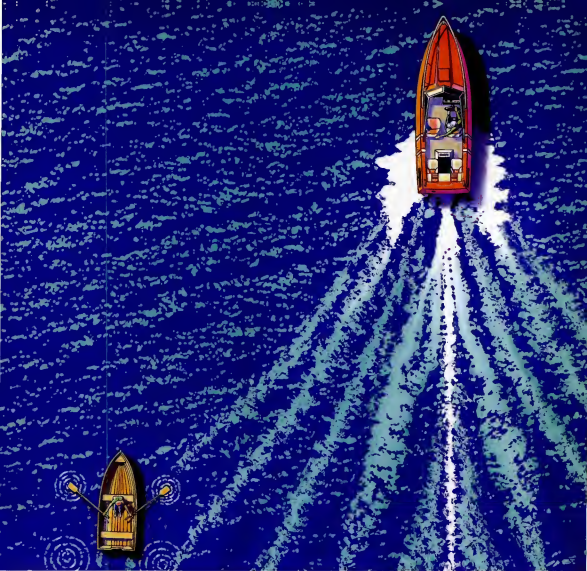


Have you seen anything offbeat, unusual, or just plain dumb about the computer industry? If so, send your submissions to *Communique's*, PC Magazine, One Park Avenue, New York, NY 10016. Please print your name legibly; include the name, city, and publication date of any newspaper or magazine clipping, and include your T-shirt size. Contributors will receive \$50 and a PC Magazine T-shirt. Sorry, but any unused entries cannot be acknowledged.

Winners for this issue: John Adams (500,000 kilowatts), Tammy Fee (Copal printer), Seth Kaufman (Lotus 30), Stephen Chandler (PS/2's final), Ernest Schurer (million megabit chip), Mark Niebuhr (DSU CSU), William Hinkle (multitasking), Stephen Eccles (lot of fonts), Wayne Kobbervig (TOPS), Ernie Schoenfeld (athletic supporters), L. Bedneux (infant mortality)



Such a big ad for public domain software: "I first became acquainted with TOPS when one of my friends in R&D gave me a copy of it," reads Philippe Kahn's testimonial to the TOPS networking system. Kahn's conclusion: ". . . But even more important is its pricing edge." Agreed.



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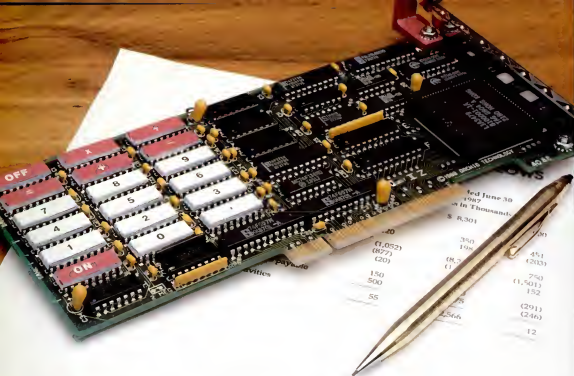
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Features	RamQuest XT/AT	RamQuest IIz	RamQuest Extra 16/32
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Maximum Memory	8 MB	2 MB	8 MB
Standard Configuration	0K, 512K, 1MB, 2MB	0K, 2 MB	0K, 512K, 1MB, 2MB
OS/2, EMS 4.0 & DOS Backfill	Yes	Yes*	Yes*
Bus Support	8 and 16 bit operation	16 bit operation	16 and 32 bit operation
Installation	Switchless and Software Setup	Switchless and 4 Keystrokes	Switchless and 4 Keystrokes
Serial/Parallel Port	Optional	No	Yes
Uses 256K and 1MB SIMMs	Yes	1 MB DRAMs	Yes
Suggested Retail Price (US\$)	\$399	\$299	\$499

* DOS Backfill on Models 50 and 60 gives zero wait-state for system memory and up to 50% speed increase.

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CIRCLE 190 ON READER SERVICE CARD

■ BILL MACHRONE



CHANGING THE SPEC

Are you a faithful guardian of the status quo or a revolutionary? Think hard before you answer that one; the truth just may surprise you.

You're no different from anyone else. You're far too busy doing your job to think about your role. If you take any time at all to think about it, you will probably conclude that a significant portion of your work entails setting standards. You control or affect the way others use PCs, whether through edicts, policies, or friendly advice. It all sounds very tame, moderating, stabilizing.

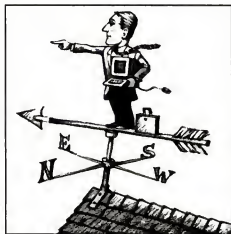
Now for the ugly truth. No matter what it says on your business card, you're reading this magazine because you're a revolutionary. You belong to a network of like-minded people who are busily turning the world on its ear. You and your cohorts are in general agreement on what should be computerized, how it should be done, and what hardware and software should be used.

Why is that revolutionary? Because you're in a small, powerful minority. You know what you're talking about and you know what PCs can do for you and for others. It doesn't sound like much until you realize that only 20 percent of the white-collar desks in America have PCs on them. The other 80 percent say they're still waiting for the computer to do something useful for them. You know it's inevitable; they haven't a clue. That's a revolution in the making.

SNAP DECISIONS When people ask you for help in selecting hardware and software, you probably think you go through a logical, orderly process, weighing the options, winnowing down the possible choices. Nah. That's not how deci-

sion making really works. All decisions are snap decisions. We spend the rest of the time agonizing over whether we made the right choice.

The basis for our snap decisions comes from a huge information base, a veritable collective unconscious of reviews, advertisements, experiences, and word of mouth. When you get together with people as well informed as you are, you find surprising agreement on the major points. You know that a user needs *GrandView*, even though you use *Agenda*. You love *Microsoft Word*, but you recommend *PFS:First Choice* to a new user. Someone wants to buy a new system for word processing, and is tempted by the low price of a turbo-8088 with a monochrome monitor. You advise her to get a 286 machine with a VGA instead. "Why?" she asks, "I'm only going to be editing text." You just smile. You could explain, but it would take too long.



CONSTANT UPDATE Truth is, you've got the specifications for that system and numerous others stored in your head. You carry them around with you, but they're far from static. You're updating them all the time. Technologies go in and out of fashion faster than hemlines. Take a look, for instance, at external hard disks. Once these units were all the rage. Now everything has to fit nicely inside the case. Likewise, removable hard disks were in, then out, now in again.

Back in 1983, only power users bought PC-XTs. Everyone else made do with floppy disks. In either case, there wasn't a whole lot of choice in software. Everybody I knew ran *WordStar*, *PC-Talk III*, and *dBASE II*. The PC was the standard. You knew by rote which add-in cards it needed, how much memory, what kind of printer cable, and how to set up *AUTO-EXEC.BAT*.

But IBM changed the spec in September 1984 when it introduced the PC AT and the EGA. The PC AT was an immediate hit; the marketplace was clearly ready for that level of performance. The EGA, however, was more of a slow burn. Everyone dutifully updated his memory banks, saying, "Someday I'm going to need EGA as a solution."

As usual, *PC Magazine* took the lead, declaring EGA to be the solution to everyone's problems. Time proved us right, but not before we took a considerable amount of grief from readers who weren't ready to move that fast. Sound familiar? Now when someone asks you for advice, you probably say, "Yeah, get an EGA if you're real-

Illustration: Roger Roth

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CIRCLE 193 ON READER SERVICE CARD

VIEWPOINTS

■ BILL MACHRONE

ly counting the pennies, but VGA is the way to go."

Two years ago, only diskless workstations had small footprints. Then IBM introduced the PS/2 series. Even though critics and competitors decried the limited expandability of these machines, the mental die was cast.

Now all the vendors are scrambling to build small-footprint models and move former add-in components to the motherboard. We're advising our less-technical compatriots that a small-footprint machine will work just fine for them because they're never going to use more than one or two expansion slots anyway. It's funny how these things work out.

SUDDEN CHANGE? The engineers call it hysteresis: that snap-action effect when all of a sudden, the conditions are different—even though they've been changing slowly over a period of time. Improving technology exerts a constant pressure, quite undetectable at first, then pow! it's time to implement a change. It's like a brick that is attached to a cart by a rubber band. Sooner or later, the pull overcomes the friction and inertia and the brick bounds forward.

Part of *PC Magazine's* job is to detect those trends, report on them, and predict their general adoption. When we do so, we're often depicted as revolutionaries or radicals. But it's all relative. You may regard yourself as much less aggressive on the technology curve than *PC Magazine*. But to your constituents, whether organizational or informal, you're a raving techno-maniac.

INFORMATION BASE The reason you're so good at what you do is that you have the ability to assimilate, abstract, and act upon information. We strive to make *PC Magazine* the primary source of that information. Our function is to change the spec, to provide critical information for the specifiers. That's why we don't dwell on the present. We're not in business to congratulate you on what you bought last year, to affirm that you made the right choice. Instead, we're likely to tell you that it's outmoded, passé. Our job is to keep you informed on the ever-changing state of the art.

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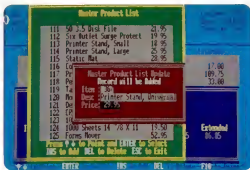
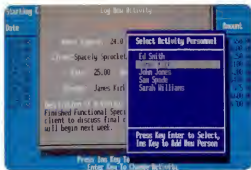


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■ JOHN C. DVORAK

HU IS ON FIRST?



If Taiwan manages to succeed in turning the island into a nation of engineers, this tiny country just might become a powerful force in the computer world.

The Taiwanese always win the Little League World Series. Since they have no professional baseball, all the talented players instead go on to college and become engineers. I interviewed the coach of one of the top Taiwan Little League teams when I was in Taipei. I knew there was a communication gap when I asked him who was on first. "Yes! Hu is on first." No, what's the name of the guy playing first base? "Hu." The guy on first base? "Hu!" Never mind. Who's on second? "No, Hu is on first." How should I know? I need to know the kid's name who is playing second! "Shih." You have a girl playing second? The gal must be good. "No! Shih!" Pretty amazing. What about third base? "Mie." You? "No, Yu is shortstop!" How did I get on the team? Me? "THIRD BASE!"

Actually not too many people in Taiwan speak English, so the above scene is almost impossible. One thing for sure, though, is that Taiwan is trying to turn the island into a nation of engineers.

It's a crazy place, and no city is more crazy than Taipei. That was recently discovered by a group of foreign journalists invited on a junket to the island by Taiwan's number-one clone maker: Acer. Acer has decided to go public and promote its branded computer. Until now, the Taiwanese company used its facilities to produce clones for Texas Instruments and Unisys, among others.

HALF-MINUTE CLONING This junket is one of the reasons you may start to hear more about Acer. I was amused by a tour

of its factory. It's as slick as any I've seen anywhere. I spent much of the time counting to myself as I watched the processes. The way I figure it, this company is producing a complete PC AT clone every 35 seconds. No slouches at production, these guys.

While writers on these things are typically herded like sheep from place to place, I always manage to break away to explore the hinterlands. What I discovered in Taiwan was enough to make your hair stand on end.

THE TAIWAN HUSTLE It's apparent that the visionary and conservative Chinese who could manage to escape the mainland during the civil strife (and the subsequent cultural revolution) did so, and many ended up on Taiwan.

Today's scene in the city of Taipei was described to me as "the same way it was in Tokyo back in the 1960s." It's pure and

total hustle hustle hustle. The whole thing is almost funny: frenetic and manic capitalism running amok.

Of particular interest to me is that the Chinese in Taiwan seem to have made an interesting (and scary) quantum jump in logic that will make this tiny nation a powerful force in the world if some trends continue. Hear this out.

THE GREAT WALL CONCEPT The Chinese learned hundreds (or maybe thousands) of years ago that no project is too difficult when you have lots of people working on it. The Great Wall of China is a perfect example of what people power can accomplish.

This knowledge has remained a Chinese resource—on the mainland, that is. In Taiwan they took the logical extension of the idea and asked, What if all these people were trained engineers? What happens if we throw unlimited numbers of engineers at a problem?

They are quickly discovering that this is a great idea. Its effect on the rest of the world has yet to be felt, but keen observers are already noticing the impact on small projects.

One only has to project the possibilities to realize that if the People's Republic of China (aka, the mainland, aka the PRC) realize that the Republic of China (aka Taiwan, aka the ROC) have stumbled on to a simple but fabulous concept, then the world's balance of power might be unalterably skewed.

It might not be a bad idea to seriously get to know these people.



Illustration: Roger Keith

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UL LISTED

■ JOHN C. DVORAK

INSIDE TRACK

Neural networks turn your computer into an electronic brain. Look out!

Brainmaker is the strangest and most fascinating computer software I've ever seen. California Scientific Systems in Sierra Madre, (818) 355-1094, is responsible for this complete software-based neural network. If you aren't familiar with neural networks, then you should learn about them. Brainmaker is just \$99.95 (don't be fooled into thinking this is toy software by this low price—it's not!) and it comes complete with a book called *Introduction to Neural Networks*. It's an excellent introduction.

OK, so what the heck is a neural network? Essentially, it's a simulation of biological intelligence designed specifically to recognize patterns in ways not achievable by conventional programming. Forget the dead end of artificial intelligence and its impossible mathematical models. Forget LISP and PROLOG. This is definitely where it's at. With neural networks you actually teach the computer how to make judgments. It creates an expert system on the fly. The drawback is that nobody can easily understand how it functions, as silly as that may sound to you. Thank goodness this column isn't running on April Fool's Day, because this bizarre software doesn't sound real.

I advise you to discover for yourself what this is all about. If you have any interest in computers, then you absolutely must learn about this stuff. Brainmaker does what hardware-based systems costing \$30,000 or more do. The company says it's faster than anything out there. It is quick, that's for sure.

As an aside, let me tell you that there are some conceptual changes you have to make in order to be able to approach this stuff. You'll discover them on your own.

Of course, I may have already been turned into a pod person!

Without trying to explain more, here's a story told to me by the talented Mark Lawrence of CSS. A guy buys Brainmaker and comes to the offices to get some help setting up his network. Lawrence says the guy has tons of statistics that he can't make heads or tails of. The guy leaves and calls back on a Monday to tell Mark that he ran the network overnight to teach it how to predict the results of certain events. "How did it do?" asked Lawrence. "Terrible. It got 2 out of 14 answers correct." The guy was disappointed.

The next week he called back and told Mark that he trained the network for 30 hours and this time it responded by getting 10 out of 14 correct. "Is that good?" asked Lawrence. "It's great. I'm going to Las Vegas next week. The program has learned to pick the winners in the NFL based on obtainable statistical data!"

Right now there are only a few cognoscenti who are aware of the breakthroughs in design that make neural networks possible (or usable). It's time we all looked at this stuff. This is hotter than hot. This is the software that will predict the next stock market crash. No kidding.

Last Guy to Plug a Product Dept.: I hate to be the last guy to plug a great product, but when it's as great as 386-to-the-Max from Qualitas, I don't mind. This is a memory manager for 386-based machines that recovers every available byte in your system and makes it usable for programs. You can move most of the memory-resident programs out of main memory and you can automatically turn extended memory into EMS 4.0 expand-

ed memory, thus making the memory more useful and easier to access. If you have a 386, then you must buy this software. It's easy to use and kind of fun too. I think this is one of the finest utilities I've seen in some time.

Unfortunately, it doesn't run under VM/386, the superb virtual machine executive (from IGC in Santa Clara, Calif.; (408) 986-8373) that allows advanced multitasking using the virtual mode available on the 80386. Theoretically, a pure virtual machine should be able to run multiple copies of itself. This means three complete DOS systems with three images of 386-to-the-Max managing the memory could be going at the same time on the 80386. Unfortunately this ability has been repressed in the 386 by design. Rumor had it that it would be implemented in the 486, but now I'm told that the 486 will be nothing more than a faster 386 with a few more bells and whistles. Maybe that's why Bill Gates is talking about the 586 already.

New Buzzword and Product Dept.: "Document finishing" is what they call it. It's the binding or improvement of the final desktop published document. If you like to show off your proposals and reports, then check out the nifty new desktop system called Unibind. This system, developed in Europe, employs a patented reusable vinyl "glue" that is permanently attached to a folder. You heat it up and get a bound book-like product. I compared the cheap \$270 Unibind system with the VeloBind and spiral-bound systems and there is no comparison. Unibind is elegant and efficient. The best part is, if you decide at the last minute to remove a page, you just pop your proposal back in the heater and pull out the page without affecting the rest of the document. Amazing. The system can bind a 650-page document. (Call Unibind in Emeryville, Calif.; (415) 652-8345.) If you like to produce fancy reports, then you need this.

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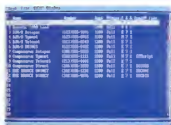
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We could go on about the many features of Symphony 2.0—how its macros let you automate complex or repetitive tasks and create customized applications. How the word processor now has a spelling checker and text outliner. And how database and communications have been improved.

The bottom line is that Symphony is one high performance package that's made to be opened up.



Lotus Symphony 2.0

■ JIM SEYMOUR

YOU DON'T HAVE TO UPGRADE



There was a time when software upgrades were eagerly awaited, mainly because the programs they were replacing were bug-filled and feature-shy. But times have changed.

When Lotus dropped its third bombshell regarding 1-2-3, Release 3.0, a couple of months ago—the news that the product would not arrive till the second quarter of 1989, later than anyone had dared guess—the moaning and groaning among users unable to upgrade from Release 2.01 for a while longer was astonishing.

A newcomer to computing would have thought Release 2.01 was terrible, full of bugs and shy of absolutely fundamental features. In fact, 1-2-3 2.01 is a classy product, rich in features, a program only a tiny percentage of users ever fully tap.

The 1-2-3 delay was surprising. What really surprised me, though, was the vehemence of users' reactions to the delay in upgrading.

Sure, long-time Lotus users have a right to complain: they've been made promises that weren't kept. And everyone always wants the newest edition of everything, from cars to computer software to this magazine. And of course, some people have been sitting on the fence about changing to *Microsoft Excel* or *Quattro*: the uncertainties of further delay keep them in a difficult position.

But at the core of the anger over the delays was the assumption that you must upgrade—which has increasingly become false, and which leads us to follow like sheep when PC software marketers prod us into line at the upgrade window.

FORGET YOUR ASSUMPTIONS The simple fact: you don't have to upgrade.

Time was, that would have been a stu-

pid position. PC software was sufficiently buggy and feature-shy that we had good reason to look forward eagerly to the next release of our most-used programs, to send in our orders for upgrade disks quickly, and to rip into those packages the second they came.

Those days are largely past. Today's PC software upgrades are evolutionary, not revolutionary. Sure, there are products such as *dBASE IV*, which finally provides the features we've needed for a long time. But far more common now are upgrades that tweak a bit here and there, add a feature or two, . . . and don't mean much to the great majority of users.

The Lotus 1-2-3 3.0 brouhaha blew through just as I was working with the new Version 5.0 of *Microsoft Word* for the PC. I'm a big *Word* fan: I know the program inside and out.

So I looked forward to the *Word* 5.0 beta package with considerable interest

and enthusiasm. I put the program on my hard disk, booted up, and went to work. I worked through the beta documentation, digging up the new features and trying them out.

They were nice. Big deal. Yawn.

After I'd used the new version for a morning, I began wondering whether Microsoft had done a poor job or I was just getting jaded. The answer, I decided, was neither. In fact, Microsoft did a nice job of realigning and refitting. But the developers started with a program that—despite my pretty substantial demands on a word processor—was already way beyond what I need. And while what they added works perfectly well, it just won't matter that much to that many people.

IT'S NO BIG DEAL So will I upgrade to *Word* 5.0? Probably. Eventually. I guess. But not with any great enthusiasm, and certainly not with any sense of urgency. Because the existing product, viewed in the cold light of the features I need and use, is just fine. In the new release, those developers were down to adding the bells and whistles—the fundamental features and performance were already well in hand.

That started me looking at 1-2-3 2.01, which I use 10 or 15 hours a week. In other words, I know it pretty well, too. While there are things I'd like changed about Release 2.01, I've already done most of that changing, through add-ins such as Lotus's own *SpeedUp*, *Personics' SeeMore* and *Look and Link*, and so on.

I despise 1-2-3's miserable graphics and think even less of the need to drop out of



■ JIM SEYMOUR

I-2-3 and use the PrintGraph routines to get a graph onto paper. But I haven't used *I-2-3* graphs in years, relying instead on *Harvard Graphics*. And while Lotus has some nice extensions to the *I-2-3* graphics

capabilities coming in Release 3.0, they won't equal what *Harvard* has been delivering for at least a year, so I'm highly unlikely to go back to using Lotus graphs, anyway.

In short, 3.0 just isn't going to be that big a deal for me. Nor, I suspect, for very many other *I-2-3* users. Some have jumped to *Excel*, and more will undoubtedly leap before we see Release 3.0 in the spring. Even for *I-2-3* users who stay with the product, I'm skeptical that there will be a huge reward in upgrading.

THINK TWICE Over the past 7 years, I've worked with micro managers in companies large and small, picking new products, and evaluating new programs—such as new-generation word processors, for instance—to pick one as a replacement for a company's existing standard. In those evaluations, we were always very, very careful to make sure we moved to new

■ Far more common now are software upgrades that tweak a bit here and there, add a feature or two, . . . and don't mean much to the great majority of users.

products only when there was a compelling reason to make a change—a reason that almost always lay in truly fundamental improvements.

Those days are now largely over. Most companies have software standards in place; they are using sound products that are well beyond the need or potential for cosmic leaps from version to version. Those companies are unlikely to leap to many new products over the next couple of years.

So today we need to show the same care and caution when it comes to upgrading from current to new versions of products that are already on our "recommended and supported" lists.

We don't *have* to upgrade. If the improvements and thus the benefits of upgrading are marginal, why change? [E]



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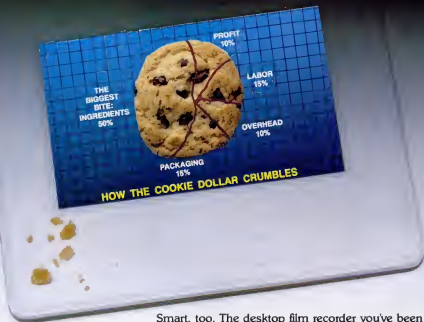
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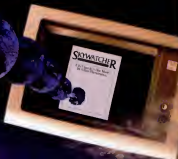
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■ WILLIAM F. ZACHMANN

THE BATTLE IS JOINED



Industry analyst Will Zachmann starts the new year and his new column with a look at IBM's losing fight for control over graphic interface standards.

In the Zoroastrian religion of ancient Persia, the cosmos is seen as the site of battle between the forces of Ahura Mazda, the god of light and truth, and those of Ahriman, the evil spirit of darkness. All history is to culminate in a final conflict between them.

As 1989 starts, the computer industry is certain to be the site of a battle every bit as interesting as that between Ahura Mazda and Ahriman. In fact, it is likely to be even more interesting since it will be much more complex.

For one thing, instead of just two sides—clearly identified as the good guys and the bad guys—there will be many players with complex alliances and rivalries. It won't always be easy to be sure who the good guys and bad guys are.

What's more, the broader conflict will be composed of numerous battles fought over related but quite different issues. Major contests will include:

- the battle between OS/2 and Unix;
- skirmishing between IBM (with OS/2 EE and the MCA) and everybody else (with OS/2 SE and EISA);
- the struggle between AT&T and OSF over future control of Unix;
- Apple's growing challenge to Intel-architecture-based IBM and compatible systems;
- the threat that new microprocessor architectures, generally RISC-based, offer to Intel and Motorola;
- the various alternative challenges posed by Steve Jobs's NeXT, by Metaphor, by Hewlett-Packard's *New Wave* and others; and

■ the growing impact of computer-aided systems engineering (CASE) and the emergence of real applications for AI and expert systems.

The forces that will take the field in these and numerous other struggles have been marching for a long time. The period from the first introduction of personal computers in 1977 (with the Apple II and the TRS 80) through 1988 was a preparation for war. Personal computers, working like OSS operatives in World War II (the U.S. Office of Strategic Services was a predecessor to the CIA), infiltrated businesses and homes all over the world.

The combatants are prepared to take the field now. The new year will see these battles joined.

The single most important struggle—because it cuts across battle lines and will help determine the outcome of many of these contests—will be over who defines the graphical user interface for the office.



Whoever wins that competition is ultimately likely to prevail in the market for home systems as well.

The OS/2 Presentation Manager and its partner, *Microsoft Windows*, are certainly the odds-on favorites. Victory is by no means certain, however. Various Unix-based alternatives pose challenges to the Presentation Manager, as does the Apple Macintosh. What's more, the Presentation Manager is itself a major battleground for warring factions.

Those of us who bet on the wrong contestants may find ourselves stranded with the early-1990s equivalent of early-1980s CP/M systems and software.

UNEASY ALLIANCES Ironically, the most bitter and intense struggle over the Presentation Manager rages between the two codevelopers of OS/2.

The origin of that conflict lies in the nearly diametrically opposite objectives that IBM and Microsoft have had for OS/2 and the Presentation Manager. For IBM, OS/2 and the PM were a critical part of Armonk's drive to create a new, much more proprietary world of PCs. With hundreds of compatible vendors eating away at its market share, IBM sought to create something competitors wouldn't be able to duplicate profitably.

On the other hand, Microsoft's aim from the start was to create an operating system environment that could be licensed and sold by every personal computer vendor who chose to do so. Microsoft, while perfectly happy to take IBM's money, wasn't interested in doing this at the cost of

■ WILLIAM F. ZACHMANN

losing its role as operating system vendor for the PC industry at large.

Strong circumstantial evidence suggests that IBM originally intended that Micro-soft would be involved only in the devel-

opment of the OS/2 core shipped as Standard Edition 1.0. It looks as if IBM planned to develop a proprietary graphical user interface, building on work done at IBM's labs in Hursley, England.

Somewhere along the way, however, it became apparent that IBM just couldn't do it alone soon enough. In a classic make-versus-buy decision, IBM's Entry Systems division opted to buy Microsoft's *Windows* technology as the foundation for the Presentation Manager. The result was that Microsoft was able not only to finesse IBM out of a proprietary user interface but also to ensure user interface compatibility with *Windows*.

This is a very unsatisfactory outcome for IBM, given its imperative to put some distance between itself and its competitors. This is all the more true, given the no-more-than-lukewarm reception for IBM's proprietary OS/2 Extended Edition, which looks as if it may go the way of *TopView* and the PCjr.

All of which explains why last year IBM began looking for ways to build more proprietary extensions to the OS/2 Presentation Manager or to obtain alternative graphical user interfaces. IBM's flirtations with Dave Liddle's Metaphor Systems and Steve Jobs's NeXT were clearly part of that effort. IBM wants desperately to come up with something that users want but only IBM can provide.

Microsoft, on the other hand, has consistently sought to prevent OS/2 and the Presentation Manager from becoming proprietary to any single vendor. Microsoft likes collecting royalties from nearly every vendor in the world and is therefore the natural ally of every user who wants to continue to benefit from real competition among personal computer vendors.

Thus IBM is likely to continue to be the loser in the struggle for control of the desktop interface, even though the Presentation Manager is likely to be the winner. Users, as well as independent software vendors, are not likely to abandon the broad plains of open software for the privilege of being ambushed in IBM's proprietary garden of delights, however tempting the fruit growing therein. □

William F. Zachmann is president of Canopus Research, an information-industry, technology, and market research firm in Duxbury, Massachusetts. He's a former columnist at InfoWorld, ComputerWorld, and PC World. His column will appear in every issue of PC Magazine.

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■ STEPHEN MANES

COMMUNICATIONS ERA? BE THERE OR BE SQUARE!



If this is the age of communications, how come we spend so much time sitting around smoke-filled airport lounges anxiously waiting for Flight 998 to arrive from Atlanta?

I'm sitting in one of those airless hotel ballrooms converted into an auditorium for the occasion—the occasion being Microsoft's 1987 CD-ROM convention. The seats are uncomfortable, my legs are cramped, and the speaker—Alan Kay, Apple's resident genius, the former Xerox PARC responsible for the laptop "Dyna-book" idea and many elements of the graphical user interfaces we are all supposed to be adopting any day now—is rambling on about bandwidth.

Actually, it's kind of interesting. Kay suggests that while the bandwidth of a CD-ROM player isn't much to write home about—roughly 150 kilobytes per second—the sheer information density of the little plastic disks can make for some pretty amazing data transfer rates. If, for example, it takes you half a second to hand somebody a CD-ROM disk, you're moving data at a peppy megabyte-per-second clip. Kay goes on to speculate about the data rate of a 747 cargo jet traveling coast to coast packed with CD-ROMs. He roughs out some volume calculations and comes up with an astronomical figure. Now that, Kay says, is bandwidth.

The whole room laughs. Kay segues into his latest nutball project—an interactive video "fish tank" that might revolutionize education if all it took to educate kids were Disney animation and megabytes' worth of hardware and software. My mind begins to wander.

COMMUNICATIONS AGE If this is the age of communications, why in the name of Alexander Graham Bell is virtually ev-

erybody who's anybody in the entire CD-ROM industry sitting in this one room at the same moment listening to a 1-hour speech anyone could read from paper in 10 minutes—and watching a demonstration that could be distributed efficiently via videocassette? If this is the age of communications, why am I sitting here suffering the debilitating effects of jet lag and wishing I could somehow multitask this thing at home, keeping one ear on the speech while I catch up on the Hot Stove League or work on the ever-growing pile of correspondence that I never seem to find time for?

Bolt of lightning! Joycean epiphany! Of course! Insufficient bandwidth! Kay has it half right: observed objectively, the real communications revolution has a lot less to do with phone lines and optical fibers and modems and fax machines than with commercial aviation. But the ultimate bandwidth isn't a pleneload of CD-ROMs—it's a pleneload of people.



GOLDEN AGE Ridiculous? "Golden-eared" audiophiles claim the "perfect sound" of CD audio disks actually includes subtle imperfections and distortions. There's no doubt that the business world—hey, the world in general—prefers face-to-face interaction to the faceless distortions of the "communications age."

It's insufficient bandwidth again. You may be talking on the phone to a warm friendly disembodied voice, but you have no independent means of confirming the voice's sincerity. You have no idea if the body connected to the voice is talking straight—or winking slyly at the underling sitting on the extra chair and covering the mouthpiece to make snide remarks about you every time you open your mouth.

And the phone is a fairly "human" medium. Get on-line with a service that offers a conference or forum, and you run into problems of discourse caused largely by the poverty of means telecommunications has to offer. Sarcasm, facetiousness, and other subtleties are so difficult to convey that on-line regulars have developed cute conventions to indicate them. But since they don't come naturally as part of the conversation, the cute little "smiling when I said that" symbols seem intrusive and awkward at best.

Even video conferencing is widely seen as a stopgap measure, a second-best last-resort method of communicating until a face-to-face meeting can be arranged. Once the novelty wears off, users of long-awaited picture-phones will have much the same reaction.

How come? Lack of bandwidth. Any

■ STEPHEN MANES

simulation of direct human interaction—in other words, any communications medium—necessarily omits certain information that's part and parcel of a personal meeting. Whole "bands" of information

drop out—information that often boils down to the rather important question, What kind of person am I dealing with? And impersonal communications methods tend to discourage exploration of side is-

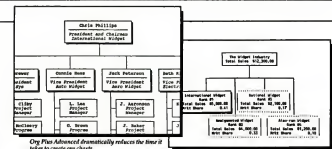
sues (How about those Tigers! Should we order lunch in or go out?) that often give you subtle clues to your correspondent's state of mind.

Other emotional subtleties fall by the wayside as well. Attend a convention and a convenient invitation to the right party or the right behind-the-scenes powwow can manipulate you into thinking you're hot stuff and favorably predispose you to your host. Attend a seminar and you can use your elbows to shove your way to the podium to get a speaker to answer your burning question. Show up in person and you'll probably find out more than you intended; exchange faxes and you're likely to find out less.

In our putative communications paradise, where a broad range of alternatives exist, the sheer number of conferences, seminars, and business meetings we all jump on planes to attend is astounding—far more than in the dark days before MCI Mail and fax machines. Many of us at *PC Magazine* travel upwards of 25,000 miles a year—once around the equator—just to get our jobs done. Dozens of executives, publicity flacks, and product managers get on planes to visit us. Despite our lip service to the communications boom, when the crunch comes what we all really want is to sit down in a room with the right person and shut the door.

That's why so many salespeople are at this moment running down the corridors of airports around the world and Boeing is the communications vendor of choice. And that won't change anytime soon, devoutly as we might wish it. Despite the evident and manifold wonders of our electronic media, no one is going to hold the World Series via electronic mail. Although telecommuting may increase, bosses are still going to want to make sure their underlings retain a modicum of flesh and blood.

You'd never think of playing poker by phone or modem; you need to be able to read your opponent's face—and adjust yours to the situation. And since so much of American business—and American life—resembles a high-stakes poker game, you'll get on the plane and suffer the bad air and worse food. So quit hogging that Skyfone and let me have a shot at it for a while—even if it has all the bandwidth of a string and two tin cans.



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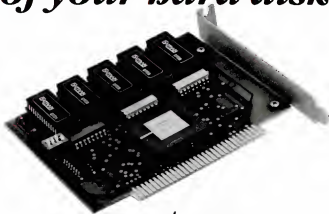
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ach year, *PC Magazine's* editors and contributing editors seek out the products that have raised both our expectations and our abilities. We seek those products that enable us to do things we could never do before. And we seek those products that spoil us for any others, that introduce new features that then become the standard by which all products in a category are judged.

Far from choosing the best-sellers or the best-promoted, however, we search for products that are the best at what they do, regardless of price or prominence. Furthermore, the award is not to the packagers and marketers but the designers and builders, the people who have truly advanced the state of the art.

In this, our fifth annual presentation of the *PC Magazine Awards for Technical Excellence*, there is ample justification for optimism, especially in the area of software. Software designers have always taken the rap for lagging behind hardware, but this year marks the advent of software that not only maximizes the latest hardware's performance, but also challenges the hardware to go faster, do more, and execute all the increasingly complex tasks set out for it.

Meanwhile, advanced hardware designs have gotten faster, smaller, and less expensive. Our desktop machines are outstripping the wildest dreams of the average user. But average users aren't the ones concerned about the state of the art, at least not today. In 2 years, maybe 3, they'll look back at the progress made on their behalf in 1988. And they'll be grateful.

PC Magazine presented these awards in Las Vegas, at 1988's Fall Comdex. Besides the luminaries and industry leaders, it was our distinct pleasure to bring out the engineers, programmers, and designers, giving them the attention they so seldom get and so richly deserve.

Bill Machrone is editor-in-chief and publisher of PC Magazine.

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Congratulating the designers of the All Chargecard, from All Computers.



■ AWARDS FOR TECHNICAL EXCELLENCE

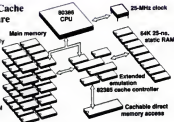
DESKTOP MACHINES

In the never-ending struggle for the hearts and minds of computer users, the battle is won and lost on the desktop. These machines are our picks for the most innovative products of 1988.



ALR FlexCache Architecture

The FlexCache 25386's technically innovative proprietary cache controller eliminates wait states by keeping frequently used data close at hand in high-speed static RAM.



WINNER

ALR FlexCache 25386 • Advanced Logic Research Inc.
 • David L. Kelly • Vic Sangveraphunsiri

In a field of powerhouse machines there can only be one winner, and ALR's FlexCache is it. Heads-up engineering, a proprietary caching system, and blazing 25-MHz performance in an industrial-strength package combine to move the FlexCache to the head of the pack. ALR has consistently advanced the state of the art—at an amazingly low price. For fast file serving, individual data crunching, or top-flight program development, the ALR FlexCache 25386 can't be beat.

FINALISTS

Dell System 220 • Dell Computer Corp.

• James Bell • Don Morrow
 • Byron Jarrett • Bill Purdon

Apart from being a terrific computer, the 80286-based Dell System 220 is one of 1988's best packaging jobs. It combines diminutive size with 20-MHz performance. It gives up nothing to more-costly 80386-based machines other than the 386's instruction set. And yet within its modest footprint is an expandable, fully optioned machine. The Dell System 220 is ample proof that advanced VLSI such as Chips and Technologies' NEAT (New Enhanced AT) CHIPSet can really make a difference.

Compaq Deskpro 386/20e • Compaq Computer Corp.

• Compaq Deskpro 386/20e Team

Compaq is the most recent member of the less-is-more club. The Deskpro 386/20e combines the winning 20-MHz performance of the Deskpro 386/20 with the winsome appearance of the 386s. Packaging, engineering, and custom VLSI combine to make an outstanding machine. Compaq has moved its VGA circuitry to the motherboard, making it the fastest we've seen yet. We heartily applaud Compaq's courage in downsizing to a 16-inch-wide footprint while maintaining speed, compatibility, and expandability.

IBM PS/2 Model 70-A21 • IBM Corp.

• Nick Donofrio • James Thomas

IBM actually moved to the head of the size/performance class with this machine. It innovates with a jumbo-sized 64K cache, up to 8MB of RAM on the motherboard, and a 25-MHz 386—all within the confines of a 14-inch-wide Model 50-sized case. Some think IBM sacrificed on expansion by supplying only three slots; we think this machine has more than most power users will ever need.

■ AWARDS FOR TECHNICAL EXCELLENCE

P

ORTABLES

Portable computers serve one of humankind's basic instincts: put a handle on it and take it with you. And never before have we been able to take so much (or so little) with us.



WINNER

NEC UltraLite • NEC Home Electronics (U.S.A.) Inc.

• Thomas B. Martin • Keith Schaefer

To some people, low weight will always be the determining factor in selecting a laptop. With the 4½-pound UltraLite, NEC moves beyond a simple lightweight into a machine that breaks new ground in integration, function, power, and style. The ultra-thin backlit display alone is a technological breakthrough, yet it is merely one of many components of the UltraLite's success. Never before has so much been offered in so small a package.

FINALISTS

Zenith SupersPort 286 • Zenith Data Systems

• Howard Fullmer • Russ Niedzielski

If you could have only one computer, you could do worse than to select the SupersPort 286. It combines power with portability, convenience, elegant styling, and real-world functionality. Its removable battery module gives users a practical choice without incurring a permanent weight penalty. And its dual-hinged screen puts your data where you can see it, while avoiding the tight-space hassles often presented by reclined seats on an aircraft.

Dolch-Pack 386 • Dolch Computer Systems

• Volker Dolch

The world needs lunchbox 386 machines, and they have to be powerful, rugged, fast, and expandable. Dolch did a superb job of condensing all the features of a 20-MHz desktop machine into a package the size of Compaq's portable, and then had room left over for three expansion slots. At a time when conventional wisdom says that only big consumer-oriented companies should be entering the market, Dolch—a small, engineering- and instrumentation-oriented company—has made an impressive debut.

■ AWARDS FOR TECHNICAL EXCELLENCE

CONNECTIVITY

The topic of connectivity seems to take much of our time and attention, and yet the field is still truly in its infancy. Almost every new product is a pioneering one, each a step along the journey to Wired America, the ultimate connectivity.



WINNER

SunRiver Workstation • SunRiver Corp.

- Ronnie D. Hughes
- Jeffrey C. Smith
- Kester B. Rice

The SunRiver Workstation is the kind of product that we love to write about. It applies state-of-the-art technology to real business problems. This fiber-optic technology makes it possible, indeed practical, for several people to run the best MS-DOS applications on a shared 80386 server. SunRiver puts the otherwise problematic video interface on high-bandwidth fiber-optic cable. The result is a closely coupled system that performs better and is more economical than LANs in many applications.

FINALISTS

Colorscan/2 • Datamedia Corp.

- Bob Brown
- Nigel Watkins
- Eric J. Thibodeau

The Colorscan/2 is an amazing little workstation, a marvel of packaging and mission-specific design. It takes advantage of the latest semiconductor and storage-device techniques to achieve seamless integration while keeping excellent flexibility. In one tiny box, it is both a PC and a VT220 clone. This dual personality, and the ease with which it slips from one to the other, makes it a natural for VAX/PC integration. Even as a standalone DOS workstation, the Colorscan/2 packs maximum power into minimum space.

LANtastic Network Operating System • Artisoft Inc.

- Alex Karahalios
- Jack Schoof

LAN operating systems should do things for you, not to you. LANtastic, from Artisoft, is the smallest, fastest, kindest LAN operating system, with the tightest code we've yet seen. For a shade over \$200 per station, LANtastic delivers electronic mail, well-designed menus, and serious network-management and security-management tools. LANtastic is technically excellent networking software.

■ AWARDS FOR TECHNICAL EXCELLENCE

DEVELOPMENT TOOLS

If there's an extra beatitude, it should be dedicated to the codemakers. And if there's a better tool, they need it. Development tools are the armament with which they sally forth to solve the world's problems.



WINNER

Turbo Debugger • Borland International

• Turbo Debugger Team • Brad Silverberg

Everyone who's tried the *Turbo Debugger* agrees: this is a spectacular product. It wins this category's award for Technical Excellence hands down. The user interface is simple yet elegant; the program works the way programmers want to work. Beyond being a terrific debugger, it also serves as an economical development system. Running on a 386, it can do nearly everything a debugging board can do, and it even ventures into some of the functions of an in-circuit emulator for hardware development. Yet again, Borland has advanced the state of the art in an eminently useful way.

FINALISTS

Sourcer • V Communications

• Frank van Giltuue

Disassemblers used to be relegated to the category of barely reputable software, as though there were something illicit in their use. A good disassembler is a valuable tool in any programmer's arsenal, in much the same way that a stud finder is indispensable to the carpenter. Professionals never know when they're going to need to modify an existing product or figure out an undocumented program. *Sourcer* is the best disassembler we've ever seen.

Pro-C • Chancelogic Inc.

• Nigel Attwell • Tim Twinn
• George Long • David van Nierop
• Peter Stephenson

Pro-C is an exceptional product, one that almost defies categorization. It's an application development environment. It's a database. It's a code generator. And it produces commented C code clean enough to be used as an example in computer science courses. Any good product can be used on several levels, and *Pro-C* is no exception. Anyone can design applications with it: you needn't be aware of its code-generation capabilities beyond a few instructions in a batch file. Others will take the source code and tune and tweak it into high-performance, highly customized applications. And *Pro-C* works with the compiler of your choice.

Clear for dBASE • Clear Software Inc.

• Yuri Kroll • Vadim Yasinovski

Great need creates a vacuum that great software tries to fill. The need to decipher programs that aren't commented, have incorrect comments, or are just too complex has been filled by *Clear for dBASE*. *Clear* reads in the original source code for *dBASE* programs and generates flow diagrams that let you see at a glance what's going on. It can also help you design and test logic and program flow before you write a line of code. Its ability to un muddy the waters of programming has earned it deserved recognition.

■ AWARDS FOR TECHNICAL EXCELLENCE

ADD-IN BOARDS

The essence of PCs is that they're never finished. As long as you have a slot open, the possibilities are endless. When we look at our nominees, it's clear that others think the same way.

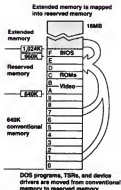


All Chargecard

The All Chargecard provides the 80286 with memory management features similar to the 80386 chip.

It increases the amount of conventional memory that DOS can directly address, from 640K to 960K, by mapping available extended memory into reserved memory (640K to 1,024K). This allows you to run device drivers, DOS programs, and TSRs in this area, leaving more conventional RAM for your applications.

Extended memory (memory beyond 1MB) may also be used by programs under DOS in a variety of ways.



WINNER

All Chargecard • All Computers

- Edward Agnew
- Jerzy Kielbasinski
- Mers Kutt
- Richard Madler
- Peter Schultz

There isn't much wrong with the 80286—at least, nothing that a little memory management wouldn't cure. The All Chargecard is just the ticket. It remaps any of the RAM available in the system with a custom VLSI chip, replicating many of the memory management functions of the 386. And the Chargecard costs a small fraction of the upgrade to a 386. Suddenly you can hide TSRs, get network shells out of the 640K workspace, and work other magic you had only dreamed about. The Chargecard is the culmination of an idea that began more than 3 years ago, and it has now homed in perfectly on the needs of the industry.

FINALISTS

Copy II PC Deluxe Option Board Central Point Software Inc.

- Michael Brown
- Alan J. Silver

The Option Board has long been the infocenter manager's main defense against mindless copy protection and the inability to back up critical and expensive software. The Option Board is still all of that, but it hasn't stood still. It has entered the realm of connectivity and file conversion as it's kept up with the times. This year, it added the ability to read and write Macintosh disks and a variety of other foreign formats.

Connection CoProcessor • Intel Corp.

- Chuck Brabenac
- Ted Forgeron
- Tracy Petrie
- Stephen Saltzman

The Connection CoProcessor, fax board with modem, is the first of a wave of new board-level products, destined to revolutionize the genre. For it includes an on-board coprocessor, one that relieves the host of the otherwise burdensome task of background communications. In an era when even the fastest machines stumble on background async communications, this is a product whose time has come.

Periscope III • The Periscope Company Inc.

- Doug Kraul
- Brett Salter

Periscope III is a clear advance in the state of the art of debugger boards. The Periscope board is highly attuned to the operation of the default software debugging product, Microsoft's CodeView. Together, they give the system developer more capability than virtually any other environment.

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This masthead was created using the fonts and typographic features of Publisher's Paintbrush.



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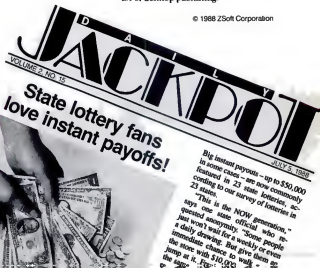
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When you can't afford to buy a laser for each PC, the **Buffalo SL[™]** is the inexpensive way to let everyone share - not just your lasers, but printers, plotters and modems as well. If you don't need simultaneous access to shared files, the SL is also an alternative to a LAN at a fraction of the cost.

The SL has four parallel and six serial channels, with all ten being user configurable as either an input or an output, so you can share 1 PC with 9 peripherals, 9 PCs with 1 peripheral, or any combination in between. If you need more than ten channels, you can link several SLs together. All channels can be in use at the same time and can rapidly transfer and queue data. The SL even allows your PC to send data at 19,200 baud. All memory (user upgradeable up to 4MB) is dynamically allocated and shared as needed.

The SL comes with software for menu-driven installation and pop-up menu control selections, but you don't have to be a programmer to use it. Of course, the SL works just fine without our software tool. The SL has many other features so ask us to send you more information.

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When 640K just is not enough, you need to add **MORE[™] MEMORY**. This Memory Extension System[™] Board uses only one slot in any 8 or 16 bit bus and can be used as expanded, extended and/or conventional memory (EEMS/EMS version 4.0 software).

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MORE MEMORY has built-in DRAM protection that corrects for any memory errors when you reboot, so you will never have to replace a faulty memory chip. No downtime or costly repairs will ever occur due to a failed memory chip on the **MORE MEMORY** board.

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■ AWARDS FOR TECHNICAL EXCELLENCE

GRAPHICS SOFTWARE

G *The first task
the original computers
were given was solving
tough mathematical problems.
The second task was
graphical representations.
Today, we've trivialized the
math tasks in a thousand different ways.
Graphics, however, remains one of the
most challenging software disciplines.*



WINNER

Micrografx Designer • Micrografx Inc.

- Steve Emmons
- George D. Grayson
- J. Paul Grayson
- Lyle Griffin

In the realm of graphics software, it's always a pleasure when you find a PC product that has more power and function than its Macintosh equivalents. *Micrografx Designer* is such a program. Not only does it have all the drawing horsepower you could desire, but it follows through in a big way for the professional. Extensive color clip-art libraries, four-color output support, and more, will cause professionals to retire their pens and T squares.

FINALISTS

Cadkey • Cadkey Inc.

- Cadkey Design Team
- Steve Mastrangelo

One thing sets *Cadkey* apart from the rest of the pack: its user interface. But that's not the only thing. While other companies are touting 3-D-like capabilities and "2½-D," all of *Cadkey*'s entities are inherently 3-D. *Cadkey 3* comes closer to the top-drawer mainframe systems than any other PC-based CADD product. And unlike virtually all the other CADD programs on PCs, *Cadkey* has a superb user interface.

AutoSolid • Autodesk Inc.

- Mike Anderson
- David Bradford
- Bob Holt

AutoSolid is unique: it is the only product that offers true solids-modeling capabilities for the PC. There are no point, line, curve, or surface entities; every object is a solid. You assemble and sculpt complex solids by using a rich set of Boolean operations. Another of *AutoSolid*'s outstanding features is its support for solid analytics involving such aspects as volumes, moments of inertia, centroids, and wetted surface areas.

Mechanical Engineering Workbench • Iconnex

- John Breen
- Robert Everly
- Steve Gaskill
- Andrew C. King
- Kapil Singh

Behind the boom in graphics is the simple notion that a picture is worth a thousand words, that seeing is believing. Nowhere is that more true than in the area of mechanical design. It's one thing to describe the geometry of an articulated hinge with formulas, and it's something else again to see it work. *Iconnex*'s product saves you the trouble of building a prototype. Simulations that formerly would have been the province of mainframes and workstations are now within reach of everyone.



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■ AWARDS FOR TECHNICAL EXCELLENCE

386 SOFTWARE TECHNOLOGY

We've been preaching the gospel of the 80386 for so long that everyone is tired of it. Everyone but us, that is. Intel's chip is at least as wonderful as we say it is, but the software is what brings it to life.



WINNER

VM/386 • Intelligent Graphics Corp.

- George Artz
- Jim Lockhart
- Jim Betz
- Ross Mahannah
- Amy Erickson
- Ken Williams

When the 80386 was introduced, everyone assumed it would be easy to use its virtual-86 mode to implement multiple DOS machines. Now, 2 years later, one program gets it right. It offers little in the way of user interface or conveniences, but it accomplishes the surprisingly difficult task of giving you virtual machines so independent that they can be crashed and reset without affecting one another.

FINALISTS

386-to-the-Max • Qualitas Inc.

- Bob Smith

Bob Smith's little product with the strange name gave 80386 owners their first real return on their investment beyond sheer speed. 386-to-the-Max reorganizes memory, hides TSRs, shadows ROMs for top performance, and more. Beyond the innovative functions, Smith has been diligent in upgrading the product as constantly evolving hardware products have changed the ground rules.

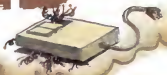
QEMM-386 • Quarterdeck Office Systems

- Therese Myers

Quarterdeck Office Systems has been at the forefront in giving the user maximum power and multiple tasks longer than virtually any other company. DESQview did what IBM couldn't accomplish with TopView, but Quarterdeck's crowning glory is the combination of DESQview and QEMM-386. Together with DESQview, this memory manager multitasks and windows DOS applications while maximizing the system's use of memory. While everyone is waiting for OS/2, people are getting serious work done every day with this powerful combination.

NEW MOUSE FOR OLD

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FOR THE NEW, HIGH RESOLUTION



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■ AWARDS FOR TECHNICAL EXCELLENCE

APPLICATION SOFTWARE

A Fortunately for all of us, some of our problems are susceptible to group solutions, and those solutions are the cornerstone of application software. Whether it's an act of courage or an article of faith, bringing forth a new application is fraught with risk. Here's to the risk-takers.



WINNER

Q&A 3.0 • Symantec Corp.

- Tim Benson
- Barry Greenstein
- Paul Lancaster
- Mike Milsner
- Brett Walter

Symantec knew it was on to a good thing with the original version of Q&A, and so did we. Version 3.0 moves head and shoulders above all the many new and worthy products we've seen this year. Q&A's designers have created a product that is all you could ask for in a file manager—and then some, with a superior word processing module, an OS/2 version, and network support. Q&A also has added retrieval from multiple files, desktop-publishing and database-publishing features, and even remote publishing via the new CAS fax standard.

FINALISTS

Agenda • Lotus Development Corp.

- Dave Burns
- Todd Drake
- Sharon Jason
- Doug Knowles
- Rich Landsman
- Dan Sevush
- Steve Zagieboylo

Other personal information managers may have preceded Agenda, but we didn't know what to call them, much less what to think about them. Mitch Kapor's quest for control over an unending flow of ideas and notes has resulted in a powerful, individualistic product. No one is on the fence about Agenda: you either love it or hate it. Love it or not, it has advanced the management of ideas and information. Lotus's courage and conviction in bringing it to market are commendable.

ProComm Plus • Datastorm Technologies Inc.

- W. Bruce Barkelew
- David Mathews
- Tom Smith

We've nominated ProComm Plus this year because it represents true elegance in program design, along with ease of use. There are comm programs with more-powerful script languages, more emulations, and more features. But none matches ProComm Plus for sheer sensitivity to users' needs. It's got every download protocol you can think of, and its user interface is state-of-the-art.

WordPerfect 5.0 • WordPerfect Corp.

- WordPerfect Corp. Development

WordPerfect Corp. has held the top spot in word processing for some years now. It got there through competent product design and excellent user support. Version 5.0, however, represents a complete redesign, adding important new features. Its ability to combine text and graphics—complete with rotation and resizing—puts a fine finish on the job. WordPerfect 5.0's excellence seems effortless, but only because of the enormous skill and effort behind it.

TYPE PRE-PRINTED FORMS WITH THE SPEED OF A WORD-PROCESSOR.

FORMS-TYPER gives you all the speed, ease, and neatness of a word-processor with pre-printed forms. If you have ever tried

SPECIAL TYPEWRITER MODE LETS YOU ADD COMMENTS ANYWHERE ON A FORM.

Turns your PC into a typewriter so that you can add information to the form as desired at any location.

FORMS-TYPER gives you all the speed, ease, and neatness of a word-processor with pre-printed forms. If you have ever tried using a word-processing program to fill in forms you know they cannot handle the precise alignment requirements of tax forms, insurance forms, Medicare forms, etc.

You no longer have to tediously align your typewriter on each blank. Just enter the information field by field directly onto your PC screen. You can also include instructions describing the information to enter in each field, so even an inexperienced typist can produce accurate, neat forms the first time.

CHANGES AND REPRINTING CAN BE DONE IN SECONDS.

Never retype an entire form over again when you need one change or correction made. All your information is stored away in files that can be retrieved to make changes for reprinting (Just like word-processing).

Defining a form is easy because FORMS-TYPEPER's unique Typewriter Mode allows you to control your printer just like a typewriter. Simply insert the form in the printer and align it. Move the printhead to each blank using the arrow keys and type "x's" on the form for the maximum length of each field. This "teaches" the program exactly where the field is and how large it is. In addition to the field name you can include a detailed description of the field and instructions to help inexperienced typists fill in the form. Defining the layout takes about as much time as it would to type the form one last time.

Other forms programs and word-processors are inadequate for pre-printed forms since most forms use non-standard spacing. FORMS-TYPER adjusts the print position by as little as 1/10th of a character so each field prints exactly where you want.

Turns your PC into a typewriter so that you can add information to the form as desired at any location.

For example, if you enter an "x" in the Overnight Priority Box on a waybill you can specify that if this condition is met, a fixed or calculated amount will be printed in the "Total" field.

These pre-built forms let you jump right into FORMS-TYPER and see just how easy it is to use. Samples provided are: Federal Express, Delta Dash, Emery, Purulorak, Quickpak Worldwide, Express Mail, American Airlines, Eastern, United, US Air, Continental, Yellow Freight, Carolina, Consolidated and Greyhound.

Printers: NEC 3500, 8800, IBM Quietwriter, Diablo/Xerox 630, C-ITOff Starwriter F10. Call for other daisy wheel printers.

Note: 360K drives need 10 MB hard disk

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■ AWARDS FOR TECHNICAL EXCELLENCE

COMPILERS/ LANGUAGES

Languages have been one of 1988's hottest areas of development. The nominees this year have pushed the state of the art in all directions. Languages maximize the programmers' ability to express their ideas succinctly. The compilers mediate the unending range war between programmers' ideas and the limits of the machines they work on.



WINNER

Lahey FORTRAN 286 and 386
Lahey Computer Systems, Inc.

- Bruce Bush
- Larry Hunt
- Thomas Lahey
- Jeff Sparkworthy
- Scott Wilbur
- Dan Wright

For too long, the promise of desktop mainframes has rung hollow. The hardware was ready, but the tools were primitive. Lahey FORTRAN broke through the doldrums and produced two compilers that exploited the computing and memory power of the PC: Lahey FORTRAN 286 and Lahey FORTRAN 386. Working with the *Lahey/Al Dos Extender OS/286* memory extender, these compilers allow full-scale program development to proceed unhindered. Scientists and engineers now have the tools they've sought for so long.

FINALISTS

Watcom C • Watcom Group

- Watcom Development Team
- Fred Crigger

Watching C compilers evolve isn't all that exciting. But while we were looking the other way, Watcom C snuck up on us. A great compiler from a company with a long lineage of compilers, Watcom C broke with tradition to make a fast, efficient C programming environment that has other C compiler designers rethinking their strategy.

Turbo ASM • Borland International

- The Borland Debugger Team

Programs written in assembly code are often praised for their speed of execution. Assembly language programmers have often been more demanding of themselves than of their tools. Now they can demand the best—and get it. Turbo ASM is fast. So fast, in fact, that you'd be silly to use anything else. More than that, it's compatible with several versions of the Microsoft *Macro Assembler*, allowing greater productivity without rewriting code. Full 386 support makes this the choice for future program development.

Zortech C++ • Zortech Inc.

- Walter Bright
- Bjorn Freeman-Benson
- Joe Huffman
- Nikk Lockie
- Joseph E. McIsaac
- Kevin Powis

While object-oriented programming isn't a new concept, its implementation on PCs is still relatively young. Zortech C++ brings this field a little closer to maturity by providing the first true C++ compiler to produce native code for the PC, along with the utilities to make a truly productive environment.

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WINNER

Microsoft Mouse • Microsoft Corp.
• Steve Shelman

Some have called it the Dove Bar. Others call it the White Mite. We call it beautiful. Few products feel so natural as the Microsoft Mouse. In this postmodern age of overdesign and ornamentation, it's a pleasure to use something so functional, yet so pleasing to the eye and hand.

FINALISTS

GRIDCase 1530 • GRID Systems Corp.
• Jim Molenda • Lee Watkins

Way back in 1984, GRID Systems Corp. laid down the basic design of the laptop DOS machine. A lot has changed since then, but some things have remained the same: the trim, functional good looks, the solid construction, and the unmistakable aura of class.

Zenith SupersPort 286 • Zenith Data Systems
• Howard Fullmer • Russ Niedzielski

The SupersPort 286 does a lot of things right, in a very agreeable package. For line-cord portability, you leave the 4-pound battery at home. For field use, you clip it on and get to work. Everything on the SupersPort 286 clicks, snaps, and thunks with agreeable solidity and precision. The double-hinged screen goes where you want and stays put. And the clean design is sure to please the most critical eye.

Diconix 300 series printers • Diconix inc.
• Bruce Enix • Park Rayfield
• David Lehman • Mike Walters

The current crop of Diconix printers are admirable for their sleek functionality. Their designers recognize that you may actually need to print out a letter and carry on a telephone conversation at the same time. These printers have gained real popularity in Europe, where their rounder corners and small footprints are appreciated as much as their quiet operation and quality printouts.

Mother Nature Can Teach Us A Lot About Hard Disks.

It can happen with no warning. The sky goes dark and then it's there. A whirling funnel that destroys everything in its path, leaving little or nothing that can be retrieved. Just the way that disaster can strike your hard disk, scattering your data to the wind.

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■ AWARDS FOR TECHNICAL EXCELLENCE

HARDWARE

*In this eclectic category,
progress waxes and wanes.
We tend to forget about
things like disks and
power supplies;
they're usually overshadowed
by the glitz and glamour
of the latest hot machines and
wild new software. But here, too, are
steady advances in the state of the art.*



WINNER

Kurta IS/1 Cordless Stylus/Puck • Kurta Corp.
• James L. Rodgers

The designers at Kurta looked at the cord that usually tethers a stylus to a computer and asked, Who needs it? They got rid of the cord by creating the first radio-controlled stylus and puck, and made it possible to draw with fluid, unhampered movements. But then they pushed the concept—and the utility—of graphically oriented input devices one step further. Template overlays, in combination with a programmable work surface, allow users to configure soft switches that can be used for applications as diverse as desktop publishing or spreadsheet macros. Nobody does it better.

FINALISTS

Turbo 375 • PC Power and Cooling Inc.

• Raymond Combs • Doug Dodson

Can something as mundane as a power supply be a serious nominee for Technical Excellence? Sure, if you like great design. Higher capacity, better regulation, super protection against overloads and shorts: PC Power and Cooling's Turbo 375 has all that, and it runs quieter, thanks to counter-rotating axial fans. When something as supposedly trivial as fan noise keeps machines out of the executive suite, power supplies are anything but mundane.

Toshiba PageLaser 12 • Toshiba America Inc.

• Yasuhiro Hatakeyama • Naoshi Obara

Toshiba pulled out all the stops and created a no-bolds-barred printer. In speed, quality, paper handling, fonts, and options, the PageLaser 12 takes top honors. This rugged beast cranks out pages that look like originals, not copies, at a rate that's fully 50 percent faster than the industry standard. Its forms-handling options and emulations redefine the high end for high-volume office applications.

Plus Passport • Plus Development Corp.

• Richard Black Borow • Sung Hahn
• Claude Camp • Bruce McGeoch

Plus Development Corp. has been at the cutting edge of small-disk-drive development for years: it invented the Hardcard. The Passport isn't the first removable hard disk, it's simply the best. Plus has covered all the bases: small size, decent performance and capacity, backup power, and durability. The developers have made it easy to boot alternate operating systems—a handy if not vital feature these days.



Awards for Technical Excellence: Previous Winners

Year	Product	Company	Category
1987	AutoShade	Autodesk Inc.	Graphics Software
	Compaq Deskpro 386/20	Compaq Computer Corp.	Desktop Computers
	Compaq Portable 386	Compaq Computer Corp.	Portable Computers
	Douglas Engelbart	McDonnell Douglas Information Systems Group	Lifetime Achievement
	ULM expanded memory specification 4.0	Lotus Development Corp./Intel Corp./Microsoft Corp.	Utilities
	Lucid 3D	Personal Computer Support Group	Application Software
	Micro Channel architecture	IBM Corp.	Special Award
	Microsoft Excel for Windows	Microsoft Corp.	Application Software
	Publisher's Type Foundry	Z-Soft Corp.	Desktop Publishing
	QuickBASIC 4.0	Microsoft Corp.	Development Tools
1986	3Com 10Mb Twisted Pair	3Com Corp.	Connectivity
	Turbo Pascal 4.0	Borland International	Development Tools
	Microsoft Windows 285	Microsoft Corp.	Operating Environments
	Zenith Perfect Monitor, Model ZCM-1490	Zenith Data Systems	Hardware
	Advanced NetWare 286	Novell Inc.	Networking
	Compaq Deskpro 386	Compaq Computer Corp.	Desktop Computers
	Bill Gates	Microsoft Corp.	Special Award
	HAL	Lotus Development Corp.	Software Add-ons
	NEC MultiSync monitor	NEC Home Electronics Inc.	Graphics Hardware
	NewViews	Q W Page Associates Inc.	Application Software
1985	Perspective	Three D Graphics	Graphics Software
	QuickBASIC 2	Microsoft Corp.	Programming Languages
	TIPS	Island Graphics Corp.	Graphics Software
	Toshiba T3100	Toshiba America Inc.	Portable Computers
	What's Best	General Optimization Inc.	Software Add-ons
	Windows, Version 1.03	Microsoft Corp.	Environments
	Zenith Z-161 Portable PC	Zenith Data Systems	Portable Computers
	Apple LaserWriter	Apple Computer Inc.	N/A
	Mike Brown	Central Point Software	Special Award
	EGA CHIPSet	Chips and Technologies	N/A
1984	Freelance	Lotus Development Corp.	N/A
	Plus Hardcard	Plus Development Corp.	N/A
	Javelin	Javelin Software Corp.	N/A
	LANLink	The Software Link Inc.	N/A
	IBM Proprinter	IBM Corp.	N/A
	Trellblazer modem	Trellbit Corp.	N/A
	Enable	The Software Group	N/A
	Framework	Ashlon-Tate	N/A
	InfoScope	Microstuf	N/A
	Intel 80286	Intel Corp.	N/A
1983	PC Blue Series	(Public domain)	N/A
	Turbo Pascal	Borland International	N/A

N/A—Not applicable. Winners were not designated by category in 1984 and 1985.

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Dennis Ritchie (AT&T Bell Laboratories)

Dennis Ritchie has been the most important influence on the decade's most important language, C. He wrote the rule book and remains an active member of the ANSI standards committee, the one that charts the future of the language. Ritchie has the long view in both directions: he knows why C was invented and what made it such a great tool; and he knows how it has to grow in order to answer tomorrow's needs. His counsel and tutelage in *The C Programming Language*, the book he cowrote with Brian Kernighan, are legendary. But his real impact is not on the system builders who took his advice to heart, but the millions of users who benefit daily from those system developers' products.





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■ AWARDS FOR TECHNICAL EXCELLENCE

P

ERSONS OF THE YEAR



The winners of the award for Persons of the Year, the Intel 80386 Design Team. Clockwise from the left: Riz Haq, Jan William L. Prak, Gene Hill, Patrick Gelsinger, John Crawford, and David Vannier.

Intel 80386 Design Team:

John Crawford

Patrick Gelsinger

Riz Haq

Gene Hill

Jan William L. Prak

David Vannier

The 80386 may only have a year until it is upstaged by the 80486. And yet the PC market has not felt the full measure of its impact, nor will it for a few years. Indeed, the presence of the 486 will hasten the 386's availability, at lower prices. In the meantime, the 80386 makes our computing lives better every day. With virtual 8086 machines, 80286 protected mode, and 80386-specific memory mapping and virtual addressing, the 386 has something for everyone—including staying power. This chip will be with us for a long time, and we couldn't be happier about it.

Bill Machrone is editor-in-chief and publisher of PC Magazine.

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The BEST of 1988

Mark down 1988 as the year of the vapors, the year of the missing products. It was as important for all of the things that were supposed to happen—and never did—as it was for things that happened and products that actually shipped. What can you say about a year when the upgrades for the market-leading spreadsheet (*1-2-3*) and database (*dBASE*) ; classic best-of-times, worst-of-times year, except we said that programs were horribly late? You can say that the timeliness of the market-leading word processor (*WordPerfect*) looked good in comparison because its upgrade was released *only* a month or two late.

You could say that 1988 was a

plied, no doubt, to both 1989 and 1990.



THIS IS THE YEAR
THAT WAS: PUZZLING
TIMES FILLED WITH
MYSTERY SOFTWARE,
MODEL STANDARDS,
CHOICE HARDWARE,
CHIP SHORTAGES,
MICRO CHANNEL
CHALLENGES, AND
OS/2'S ASCENT.

You could certainly say 1988 was a year in which software didn't outshine hardware.

SPEED THRILLS PC performance climbed another notch. The 16-MHz Compaq Deskpro 386, the first machine based on Intel's 32-bit 80386 processor, had evolved by June 1988 into a 25-MHz Deskpro 386/25. A 33-MHz 386 may be in the offing for 1989; so will the Intel 80486 (the chip at least, if not any products based on it). The 386 and 486 will exist side by side, in part because 486-based PCs (essentially deskframes) will make 386 PCs look dirt cheap. A vanilla 486 might run \$20,000 with a bit of memory and a suitable hard disk.

At the same time that it pushed the 386 to 25 MHz, Compaq introduced the first PC based on the Intel 386SX processor. The so-called P9 hybrid chip combines an AT-style 16-bit external data path with the internal structure of a full-fledged 386. To your hardware, it's a 286, and you can use AT-class memory cards. To your software, it's a 386, ready to use 386 operating systems. To your pocketbook, it's mostly a 286: a machine with a 386SX costs \$100 to \$500 more than a comparable 286 PC. To chipmakers Harris and AMD, who want you to buy fast 80286s (guess who doesn't have rights to build the 386 and 386SX), it's trouble with a capital T. AMD conceded that demand for the 286 chip had collapsed by year's end.

PS/2 Micro Channel PCs have received a decidedly mixed reception in the marketplace. While absolute unit sales continue to climb, IBM's share dropped to about 30 percent of the PC market in 1988; in 1987 it was 50 percent. To spur sales, IBM hiked dealer sales quotas (dealers promptly offered stronger discounts and stoked the gray market supply lines) and introduced a PC trade-in program that went nowhere fast. IBM offered approximately \$1,150 in trade for a used AT 339 that might bring twice that amount on the open market.

IBM was hurt most at the top of the food chain. Compaq sold as many as, or more, 386-based PCs as IBM did.

What a difference a year makes I: IBM talked about performance when it rolled out the PS/2 line in April 1987, but in 1988

THE IMPORTANT TRENDS OF 1989

Fortune-tellers always make sure they're paid up front, so that should tell you something about how certain the prognosticating business is.

Nonetheless, somebody's got to stick his neck out. Expectations must be kept high. Risks must be taken.

So here are the trends you'll see in 1989:

■ Laptops will make incredible leaps forward. NEC broke through early this past fall, and a flood of under-5-pound laptops will appear from manufacturers that have until now sold only desktop PCs. The 2-inch disk will emerge as the disk of choice for these super-laptops.

■ Intel will unveil the Intel 80486, but it will have virtually no impact on PCs. Manufacturers of super-minicomputers and workstations will rush to adopt it while PC makers concentrate on 386 and 386SX PCs. Prices of 386SX-based PCs will come down faster than those of most other PCs.

■ 286- and 386-based PCs will grow smaller as more features are built onto the motherboard. Innovation in 8088-based PCs will crawl to a halt; instead, manu-

facturers will concentrate on selling them from outlets like K-Mart and Sears.

■ A 32-bit (386-only) version of OS/2 will debut to disappointing reviews. OS/2 Presentation Manager applications will trickle onto the market until, around summertime, the trickle becomes a stream. By the end of 1989, about 5 percent of all PCs will be running OS/2.

■ The Unix standard will keep spinning in confusion. Every time it seems to settle down, IBM or AT&T will set it into motion again.

■ OS/2 LAN Manager will take the ground that OS/2 Extended Edition was supposed to grab.

■ The first EISA PC will be introduced in the fall. It will be expensive, attractive, and clearly intended to be a server, but greedy power users will gobble it up as their own PC.

■ A flood of 1-megabit RAM chips will end the RAM shortage of '88; 64- and 256-kilobit chips will become harder than ever to find.

■ And, finally, one sure bet: IBM will introduce yet another completely new graphics standard.—Gus Venditto

we heard a lot from IBM about PS/2 reliability. Reliability is important, but it doesn't have the visceral impact of performance. While Big Blue can make a convincing laboratory case for the technical superiority of the MCA bus, the marketplace hasn't observed much of a difference between MCA and classic-bus PCs running the same processors at the same speeds, when both run today's software and peripherals.

What a difference a year makes II: over the past year IBM seemed concerned that everyone wanted to clone the Micro Channel; this year IBM's most fervent desire is that somebody will. A slew of MCA-compatible announcements was followed by little real product; Tandy was the first to offer an MCA compatible.

IBM swallowed its Micro Channel pride enough to reintroduce an AT in drag: the PS/2 Model 30 286, with the AT's

80286 processor and "industry-standard" bus, as Compaq likes to call it. IBM calls it a PS/2 because it has that cute little space-saver chassis, 3½-inch drives, and built-in VGA. Which is it, AT or PS/2? Hint: When you go shopping for expansion boards for the Model 30 286, ask the clerk for AT-type boards. PS/2 boards won't fit.

GANG OF NINE Compaq was the ring-leader in the so-called Gang of Nine (AST, Compaq, Epson, Hewlett-Packard, NEC, Olivetti, Tandy, Wyse, Zenith) that unveiled plans for an MCA alternative, the Extended Industry Standard Architecture (EISA) bus. The EISA consortium believes it can attain the Micro Channel's performance benefits with a modified classic-AT bus. The first products are still many months away, and you'll need special add-in boards to take advantage of the EISA spec. PC and AT boards will run in

the EISA bus, but they won't run any faster just by virtue of being in a smarter bus—just as you won't.

Other pairings and couplings in 1988 revolved around Unix, the powerful Rodney Dangerfield operating system for engineers and scientists that wants more respect from the rest of us, who find Unix too cryptic and hostile in its native state. AT&T and Sun Microsystems, the Big Blues of the Unix world, got together to announce *Open Look*, a Unix front end intended to make users think of a Macintosh or a PC with Presentation Manager. While Unix, Version 4, with a friendly interface (based on PARC's X Windows protocol) isn't likely to show up on Tandy 1000s used in the John F. Kennedy JHS computer literacy program, it could elbow its way into the DOS/Mac business mainstream since more than a few PC programs have Unix versions.

The thought of AT&T and big, brash Sun in cahoots so unnerved the rest of the industry that it formed an alternative Open Software Foundation (OSF) dedicated to keeping Unix open and announced an alternative Unix based on AIX, IBM's implementation of Unix. (IBM, DEC, and Hewlett-Packard were among the OSF signatories.) Cygnics were quick to point out a side benefit for unlikely bedfellows IBM and DEC: if OSF created uncertainty about the likelihood of a single Unix standard, the resulting confusion would keep existing IBM and DEC mini and mainframe customers in the embrace of proprietary IBM and DEC operating systems.

THE LEGAL FRONT If you built a windowing interface in 1988, you were likely to hear the words "See you in court." Apple sued Microsoft and Hewlett-Packard, alleging that the look and feel of the Macintosh environment was ripped off by the *Windows* and *New Wave* (HP's *Windows* offshoot) environments. Apple, of course, owes much of the Mac's look and feel to work originated at Xerox, not Apple. (*Open Look* has its roots in Xerox research, too.) Could it be that Apple grows nervous as PCs with graphical user interfaces approach the Mac's ease of use? Apple shouldn't be, yet: PCs with windowing environments are easier—not easy—to use than PCs with DOS. If Apple has a

cloud on its horizon, it stems from the absence of affordable Mac compatibles. Imagine how successful the DOS world would be if your only vendor were IBM and your only pricing structure were IBM's.

IBM sought to share in the success of its competition by hiking royalty fees for anyone building classic-bus or Micro-Channel PC compatibles to as much as 5 percent of



MICROSOFT ORCHESTRATED A HUGE PR CAMPAIGN FOR ITS OS/2 LAN MANAGER OPERATING SYSTEM. FEW ROYAL BIRTHS HAVE RECEIVED SUCH HERALDRY.

sales. Not coincidentally, many compatible-makers earn around 5 percent profit, so they have the choice of operating without profit (unlikely) or hiking prices to cover the royalties. That's part of the reason why you're seeing so few PS/2 compatibles: they cost more to build, even before you figure in royalties. Dell Computer chairman Michael Dell estimated that PS/2 compatibles might command 20-percent price premiums. Users, of course, won't see anything like 20 percent performance premiums.

IBM also dusted off other patents dating as far back as the mid-1970s and warned competitors of the consequences of infringement. Who among competitors will fare best if IBM stays tough? Anyone who has patents IBM needs to license. Then both sides can talk Let's Make a Deal.

CONNECTIVITY In connectivity, 1988 was the year for consolidating positions and making alliances. Translation: here as elsewhere, there were more plans than products. Microsoft orchestrated a huge PR campaign for its *OS/2 LAN Manager* operating system. Few royal births have received such heraldry, especially since you can't even buy something called *LAN Manager*. Instead, you buy a *LAN Manager*-based product modified by a third party, such as 3Com's 3+ *Open*.

Novell consolidated its position by stripping away excess baggage (some hardware), tuning up *NerWare*, and porting it to other environments. Apple's large investment in networking paid off with an open networking protocol and a very important alliance with DEC.

IBM consolidated and improved its position on its Token-Ring Network by dangling the bait of improved mainframe connections in front of prospective buyers. IBM showed that the Systems Application Architecture (SAA) is a bedrock-level foundation for integrating future applications across computer systems. On PCs you'll see SAA as Presentation Manager.

Moving the same old networking software to a 386 file server helped performance, but the real payoff will come from the emergence of the true 386 protected-mode operating systems just around the corner. The power of the 386 chip is also responsible for the growing importance of multiuser/multitasking operating systems. In turn, multiuser/multitasking DOS-compatible operating systems are responsible for the increased importance of low-cost terminals that emulate the graphics and keyboard of the PC.

YEAR OF THE STANDARD If PC users want to work together seamlessly, they need standards that allow them to share information better. For instance, SQL database-query engines hold out the future

promise that any software on any computer that talks SQL can get information from any other computer equipped with SQL.

Individual software programs have evolved common file formats for the PC and the Mac, allowing you to build an office network with Macs as part of the mainstream rather than as standalone sops to those individualists over in the graphics department. *Microsoft Word*, *Excel*, *PageMaker*, *dBASE*, and *WordPerfect*, among others, have standardized file formats in both versions. Most spreadsheets now accept on-the-fly file translation from *Lotus 1-2-3* worksheets; more than a few databases do the same with *dBASE II* and *dBASE III* files; and just about every CADD program translates *AutoCAD*'s .DXF files. Within the *Microsoft Windows* environment, DDE (dynamic data exchange) is evolving as a sophisticated way to move data among programs. Microsoft has a whiz-bang demo in which a communications program captures incoming stock price data, pumps it into *Excel*, then hands it off to a charting program.

THE DICAS OPTION Intel outlined a communications standard that might let you distribute a document from your PC to anyone who is on your LAN or office-wide e-mail system, who can be reached by a modem, or who has a fax machine. When you're ready to send a document (a memo, a spreadsheet, a database report), you choose the DCA/Intel Communications Application Specification (DICAS) option instead of a paper printer and choose a distribution list of anywhere from one to hundreds of people. Right now the spec is limited to 9,600-bit-per-second fax output on Intel's \$995 Connection CoProcessor, with a 2,400-bps modem option. If DICAS takes off, users won't have to worry about an alphabet soup of communications protocols or any other alternative delivery methods.

The biggest common standard that users can see and use is Presentation Manager (PM), the graphical version of OS/2. PM is both an operating system and a standard because of a consistent user interface and common command structures for programs that run under PM. With most PM programs, for instance, the File menu will always be in the upper-left corner of the



The Best Products of 1988

Product	Company	Date reviewed
<i>Agenda</i>	Lotus Development Corp.	December 13, 1988, page 98
<i>All Chargecard</i>	All Computers	December 27, 1988, page 43
<i>ALR PlusCache 25386</i>	Advanced Logic Research Inc.	September 13, 1988, page 35
<i>Apple LaserWriter IINTX</i>	Apple Computer Inc.	October 31, 1988, page 116
<i>askSam</i>	askSam Systems	December 13, 1988, page 102
<i>Cadkey</i>	Cadkey Inc.	August 1988, page 134
<i>Compaq Deskpro 386S</i>	Compaq Computer Corp.	August 1988, page 93
<i>Compaq Deskpro 386/20e</i>	Compaq Computer Corp.	October 31, 1988, page 33
<i>Compaq Portable 386/25</i>	Compaq Computer Corp.	September 13, 1988, page 36
<i>Compaq Deskpro 386</i>	Compaq Computer Corp.	October 11, 1988, page 100
<i>Connection CoProcessor</i>	Intel Corp.	October 31, 1988, page 52
<i>Curtis Clip</i>	Curtis Manufacturing Company Inc.	Not previously reviewed in PC Magazine
<i>DataEase</i>	DataEase International Inc.	November 15, 1988, page 246
<i>Feedback Plus</i>	Fifth Generation Systems Inc.	May 31, 1988, page 108
<i>Flash V Disk Accelerator</i>	Software Masters Inc.	November 24, 1987, page 238
<i>Flight Simulator</i>	Microsoft Corp.	October 31, 1988, page 508
<i>GrandView</i>	Symantec Corp.	December 13, 1988, page 113
<i>Graph Plus</i>	Micrografix Inc.	September 27, 1988, page 136
<i>Hewlett-Packard LaserJet IID</i>	Hewlett-Packard Company	Not previously reviewed in PC Magazine
<i>IBM PS/2 Model 70-A21</i>	IBM Corp.	November 15, 1988, page 110
<i>IBM Quickwriter</i>	IBM Corp.	October 31, 1988, page 285
<i>Kurta IS/1 Cordless Stylus/Puck</i>	Kurta Corp.	Not previously reviewed in PC Magazine
<i>Lahey FORTRAN 386 and 386</i>	Lahey Computer Systems Inc.	Not previously reviewed in PC Magazine
<i>MathCAD</i>	MathSoft Inc.	March 15, 1988, page 43
<i>Micrografix Designer</i>	Micrografix Inc.	April 26, 1988, page 56
<i>Microsoft Mouse</i>	Microsoft Corp.	February 16, 1988, page 211
<i>NEC UltraLite</i>	NEC Home Electronics (U.S.A.) Inc.	November 15, 1988, page 33
<i>PageMaker</i>	Aldus Corp.	December 27, 1988, page 124
<i>Paradox OS/2</i>	Borland International	September 13, 1988, page 43
<i>Paradox 386</i>	Borland International	June 14, 1988, page 33
<i>Periscope III</i>	The Periscope Company Inc.	August 1987, page 43
<i>PFS:First Choice</i>	Software Publishing Corp.	March 15, 1988, page 222
<i>Plus Passport</i>	Plus Development Corp.	September 13, 1988, page 258
<i>ProColor</i>	Matrix Instruments Inc.	Not previously reviewed in PC Magazine
<i>ProCom Plus</i>	Daetastorm Technologies Inc.	July 1988, page 180
<i>Q&A 3.0</i>	Symantec Corp.	May 31, 1988, page 43
<i>QEMM 386</i>	Quintessential Office Systems	Not previously reviewed in PC Magazine
<i>Quickran</i>	Intuit	December 27, 1988, page 372
<i>Relay Gold</i>	Relay Communications Inc.	July 1988, page 179
<i>SFT NetWare</i>	Novell Inc.	June 14, 1988, page 156
<i>Survivor Workstation</i>	Survivor Corp.	Not previously reviewed in PC Magazine
<i>Super Cartridge I</i>	IQ Engineering	July 1988, page 38
<i>Super PC-Kwik</i>	Multisoft Corp.	January 13, 1987, page 43
<i>386-to-the-Max</i>	Qualitas Inc.	January 12, 1988, page 43
<i>Turbo Debugger</i>	Borland International	November 15, 1988, page 34
<i>Venture Publisher</i>	Xerox Corp.	December 27, 1988, page 130
<i>VM/386</i>	Intelligent Graphics Corp.	January 25, 1988, page 33
<i>WordPerfect 5.0</i>	WordPerfect Corp.	November 29, 1988, page 117

menu bar and will always contain the File Open, File Save, and File Print menus. The first PM applications will likely be ports of *Microsoft Windows* products, aided and abetted by *Mirrors*, a Micrografix product that allows quick translations from *Windows* to PM with little or no reprogramming.

On new PCs, VGA has evolved as the graphics standard. It costs no more than EGA, offers higher resolution (640 by 480 vs. 640 by 350), and includes a fallback to EGA for programs that don't yet support VGA. IBM and Compaq no longer even bother to sell EGA boards. Support is still building for the next step up, IBM's 8514 video standard that has 1,024 by 768 resolution and falls back to VGA. One problem with the 8514: the IBM spec calls for interlaced displays (the adapter displays the odd-numbered lines, then goes back and fills in the even-numbered lines), while some 8514-alikes are being developed as noninterlaced adapters that provide more stable (less flicker) displays. The cost is reduced compatibility.

One standard in flux remains floppy disk drives. Unless you're in a PS/2-only environment, 5¼-inch floppies still hold sway. Your best bet: order new machines with both 5¼- and 3½-inch high-density (1.2 and 1.44MB, respectively) drives.

IMPROVED HARDWARE Hewlett-Packard followed its triumphant LaserJet Series II with the IID, a dual-bin, duplex (both sides) printing version that also allows you to rotate any font 90 degrees for landscape printing. Apple's new crop of LaserWriters (LaserWriter IINT, IINTX) have the second-generation Canon LBP-SX engine of the LaserJet Series II and improved PostScript routines that markedly reduce the time to output complex graphics pages. Qume's CrystalPrint WP reduced the street price of text-only, no-graphics page printers to under \$1,000.

Microsoft increased its stranglehold on the alternative input market with the ergonomic redesign of its mouse. Logitech, the Avis to Microsoft's Hertz, and others scrambled to establish more-comfortable designs.

Plus Development Corp., master of the HardCards, unveiled a pricey removable-hard-disk system, the Plus Passport, with

\$595 (20MB) and \$795 (40MB) disks—expensive for casual users, priceless when data security is paramount. Tandem fared well with a similar system, the Ad Pac.

Fax boards remained an immature market. Compared with nearly idiot-proof fax machines, fax boards and software have a ways to go. The DICAS spec may give fax boards the boost they need to take off in 1989. Just remember: if you're holding a paper document in your hand now, it's always easier to fax it.



OS/2 WASN'T HELPED ANY BY THE ROLLER-COASTER PRICES OF MEMORY CHIPS.

Tandy surprised the industry with the announcement of a THOR erasable optical drive that will have variants for data and for audio recording. Even if the technological pieces fall together for Tandy, THOR may still be 2 years off.

Meanwhile, potential users of PC-based read-only CD-ROM drives remain perplexed by the question, why do CD drives for PCs cost \$500 more than CD drives for your stereo? Until drive prices subside, CD-ROM's biggest market is huge financial and business databases that change on a monthly basis, and in which the cost of the CD reader fades in comparison to the cost and value of the data.

The most broadband CD-ROM application to date, *Microsoft Bookshelf*, begs the question: will users plunk down \$295 for a half-dozen interesting but not exceptional reference volumes? *Bookshelf's*

modest sales may furnish the answer.

Industry leader Matrix knocked the price of quality film recorders (slide makers) down below \$9,000 with its ProColor. Even medium-sized businesses may now find it's cheaper to create slides in-house. Another company, Mirus, showed a similarly priced device based on radically different technology.

NEC was the first to unveil a full-function DOS laptop weighing less than 5 pounds, and other companies have plans to follow suit late in 1988 or early in 1989. Compaq finally brought out a laptop with advanced power-management features to squeeze extra life out of the batteries. A hard disk announced by PrairieTek (due to ship in the spring) will help laptops combine power and portability: the 2½-inch drive will weigh only 9 ounces and store 20MB.

IBM's sales of the PC Convertible were so bad that IBM reps, who normally are disinclined to tell or take a joke in public, actually laughed (well, chuckled politely) when the question of Convertible sales came up at a press conference.

WORKGROUPS AND PIMs Workgroup computing and personal information managers (PIMs) kept the software side of 1988 from sliding into total catatonia. Workgroup computing is a fancy way of saying, "We notice people in offices do their work together, and now that you're up on a network, here's some software that lets you split up the work, comment on the work, and set up meetings that don't conflict with anyone else's meetings." Broderbund Software's *For Comment and Action Technologies' The Coordinator* are prime examples of workgroup-comment and structured-group mail/calendaring programs that function best across a network, although the rigid dogma underlying *The Coordinator* costs it potential sales. Lotus's *Notes*, a workgroup "conferencing" program that's still in development, may be a harbinger of the future. It requires Presentation Manager and is to ship in 1989.

Personal information managers store and categorize information that needs more structure than word processor note files can accommodate, and more variety than a database allows. They can have ele-

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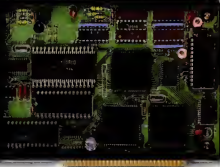
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CIRCLE 749 ON READER SERVICE CARD

■ BEST OF 1988

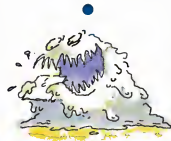
ments of text retrieval, outlining, hypermedia/hypertext, and tracking/time management. Lotus coined the term when it announced *Agenda* at Fall Comdex 1987, and the rest of the industry stumbled over itself to proclaim its products to be just as capable as *Agenda*, easier to use, and cheaper. In truth, many of the products are more different than alike. Other PIMs of note include Symantec's *GrandView*, Persoft's *IZE*, Polaris's *PackRat*, and Valor's *Info-XL*. PIMs have yet to prove they're a major category; sales so far have been disappointing for even the most heavily promoted products.

If you judge a PIM by how well it accomplishes what it sets out to do, *GrandView* is the best and most usable at its chosen task: outlining. *Agenda* may be the most powerful and visionary, but it stumbles on ease of use. Ironically, *Agenda* creator Mitch Kapor has long been a harsh critic of overly complex and tricky hardware and software.

One of the best examples of power without excessive complexity was Symantec's *Q&A*, a database that added lookup tables in Release 3.0. Users who think they need a relational database often find they're satisfied if they can link one file to another by a common element; for instance, an employee payroll linked to a personnel history by the employee's ID number. *Q&A* includes a word processor module that's better than all but a handful of the 50-plus standalone word processors. Keep an eye on Symantec; chairman Gordon Eubanks possesses one of the ablest minds in the industry.

Upgrades of Aldus's *PageMaker* and Xerox's *Ventura Publisher* moved those products one notch closer to perfection. *PageMaker* remains the tool for complex page designs; *Ventura*, for lengthy documents. But they've grown more alike as they've grown more capable. These two need to move upmarket because graphical word processors have begun to blur the line between word processing and the first rungs of DTP. *WordPerfect 5.0* is the best example that shipped in 1988, and you can expect to see several *Windows*-based WYSIWYG word processors by mid-1989, including a *Windows* version of *Microsoft Word*. Ports to Presentation Manager won't be far behind.

And what of OS/2? The character-based version of OS/2 (1.0) reached its first birthday late in 1988 with only a handful of applications up and running. (IBM had been quoted as saying it expected a thousand OS/2 apps by year's end.) Most developers are saving their energy for OS/2 1.1, the Presentation Manager. IBM's version of Presentation Manager was to ship by the end of 1988, with other vendors chiming in throughout 1989. Unlike DOS, where anybody's version of DOS works on most any maker's PC, OS/2 is machine specific. If you have a



WHAT COULD BE WORSE THAN BUGS? VIRUSES.

Tandy, you buy Tandy OS/2.

You may even see an 80386-specific version of OS/2 by the end of 1989 or in 1990. When OS/2-386 ships, vendors who haven't moved ahead on Presentation Manager apps may take a reading of the OS/2 market to see how many 286s are OS/2-capable compared with 386s. If the answer comes up 386, some may opt to bypass character-based OS/2 and the first round of Presentation Manager (the one that runs on both 286s and 386s) for the industrial-strength OS/2-386.

When does OS/2 overtake DOS? By Microsoft's own estimate, OS/2 won't have half the market until 1991. OS/2 wasn't helped any by the roller-coaster prices of memory chips. Chip prices jumped sixfold from 1987 to 1988, from about \$2 to a high of \$12 for a common 256-kilobit chip (you need 9 to add 256K

of memory, 36 chips for 1MB), and prices for a 2MB memory board rose from about \$900 to \$2,000. OS/2 wants 4 to 5MB to be useful, so DOS looked to be a safer and safer short-term bet.

IBM upgraded DOS to Version 4.0, adding a file manager, icons, and mouse support (hello, Mac), support for drives over 32MB, and a bunch of bugs in the initial 4.0 release.

What could be worse than bugs? Viruses. Fears about viruses and Trojan horses made vaccination programs popular. Mass-circulation publications made viruses a hot topic; a *Time* magazine cover story managed simultaneously to draw parallels between AIDS and computer viruses and to cluck at anyone who'd think of the two in the same breath.

BEST PRODUCTS What were the year's best products? For the definitive statement, *PC Magazine* editors culled the Editor's Choice selections of the past year and looked at a handful of promising new products that hadn't completed formal review cycles. In a series of face-to-face editorial conferences and in MCI Mail group discussions that continued late into the night and on weekends, the magazine's senior staff and contributing editors argued the merits of more than 100 products. Some products were brought back into PC Labs for second and third looks.

The summaries on the following pages were written by the editors who have had the most hands-on experience with the products.

If you've read previous *PC Magazine* best-of-year roundups, you'll notice fewer products this year. The industry hasn't gotten worse; we've gotten tougher. This year we focused on the best products that were new or substantially improved in 1988. *Microsoft Excel*, General Information's *Hot Line*, the Kurzweil Discover 7320, and Traveling Software's *Lap-Link* are all superior products and among the best of 1987, but even with new version numbers, they're roughly similar to the great products they were a year ago.

These 33 products, plus the 11 product winners of the Awards for Technical Excellence, represent the collective judgment of *PC Magazine*'s senior staff: the best of 1988.—Bill Howard

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- ① Show TrendSetter where your data is,
- ② Tell it how far in the future to forecast,
- ③ Show it where to put the results, and
- ④ "Go".

TrendSetter puts results directly on your worksheet, showing upper and lower bounds for the forecast plus other measures of statistical accuracy. The manual explains what they mean. You can easily modify forecasts with Lotus to reflect your own judgment. TrendSetter even writes Lotus macros so you can graph your forecasts at the press of a key.

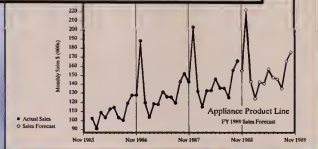
That's it! With Add-in convenience.

TrendSetter Expert makes consistently better forecasts. Here's how.

TrendSetter Expert uses time-series extrapolation techniques to forecast future values based on the past. Proprietary expert-systems logic examines the history data and combines several sophisticated statistical analysis techniques to produce the forecast. TrendSetter Expert even allows for seasonality to accommodate, for example, yearly holiday sales peaks.

Just how good are TrendSetter Expert forecasts? Superlative! In a widely respected forecasting competition, 24 different forecasting methods were pitted against 111 sets of diverse real-world data. Using the same data, TrendSetter produces more accurate forecasts for 88% of the test cases, and better than the average for the rest! (Details available on request.)

Series Type	Monthly	Date	Forecast	Upper	Lower	S Factor
First Actual:	1	Nov 1986	158	158	153	1.43
Confidence		Dec 1986	221	225	217	1.44
Level:	89.06	Jan 1987	163	168	158	0.95
Interval:	3	Feb 1987	124	130	119	0.82
Mean:	129	Mar 1987	163	168	157	0.94
Std Deviation:	24	Apr 1987	161	166	156	0.93
Minimum:	91	May 1987	167	184	160	1.01
Maximum:	203	Jun 1987	167	199	140	0.96
Grand Line Slopes		Jul 1987	169	184	158	0.93
Entire Range	1.28	Aug 1987	135	144	127	0.88
Last Half:	0.98	Sep 1987	188	174	187	1.04
Seasonality		Oct 1987	176	183	169	1.10
Auto(+):	12					



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Don't misunderstand. No forecasting method is perfect. But TrendSetter Expert will help you make better forecasts than you do today. Guaranteed. Or your money back.*

So don't wait! Make an expert business decision right now. So you can make expert business forecasts in the future. Buy TrendSetter Expert.

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*If you aren't satisfied for any reason, return TrendSetter for a refund (if purchased directly from Concentric or an Authorized Reseller). TrendSetter Expert works as an Add-in with 1-2-3 Releases 2 and 2.01, and with Symphony Releases 1.1 and 2.0 on IBM® PCs and compatibles with PC-DOS 2.1 or later and a hard disk. 5.25" and 3.5" diskettes included.

Another timesaving tool from the authors of R&R Relational Report Writer® for dBASE® and R&R Worksheet Report Writer™ for Lotus.

TrendSetter EXPERT

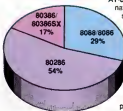
Concentric Data Systems, Inc.
18 Lyman Street, Westboro, MA 01581



The STATE of the PC 1988

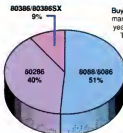
Is the 8088-based PC a goner? How's the Micro Channel faring? Have laser printers caught on in a big way yet? For a rundown on the state of the PC, PC MagNet polled users in October on what they're using and what they plan to be using in 1989. Responses from 800 MagNet users yielded a snapshot of where we stand as the PC industry enters its eighth year.

1. What kind of processor is in your office computer?



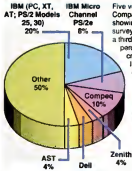
AT-class and better machines dominate the office. Only one user in four still plods along on an 8088- or 8086-based PC. Already a sixth of the survey's users have 386-based PCs with more on the way: Microsoft predicts that sales of 386 chips will equal those of 286 chips by year end. What are the PCs used for? The top applications, according to at least three-quarters of those surveyed: word processing, spreadsheets, and database management. Also popular: graphics, desktop publishing, and accounting.

3. What kind of processor is in your computer at home?



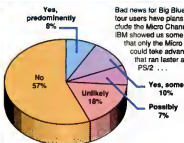
Buying patterns for the PCs-at-home market lag those of the office by a year or so. Our survey reports that Tandy and Leading Edge are especially popular as after-hours PCs; they're Numbers 3 and 4 behind IBM and Compaq.

2. What brand of computer is it?



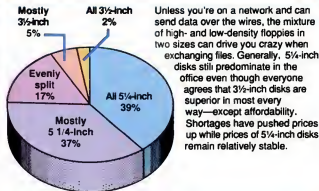
Five vendors sell half the PCs: IBM, Compaq, Zenith, Dell, and AST. IBM's showing here dovetails with other surveys that give Big Blue just under a third of the market, down from a 50 percent share 2 years ago. Don't cry too hard for IBM's plight: IBM's unit sales continue to increase; it just has a smaller piece of a bigger pie. (Apple, not represented in the survey because PC MagNet targets the MS-DOS market, has about a fifth of the overall market.)

4. Does your company plan to switch to Micro Channel PS/2s within the next 12 months?

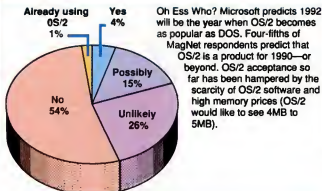


Bad news for Big Blue: three out of four users have plans that don't include the Micro Channel. Maybe if IBM showed us some applications that only the Micro Channel could take advantage of, or that ran faster and better on a PS/2 ...

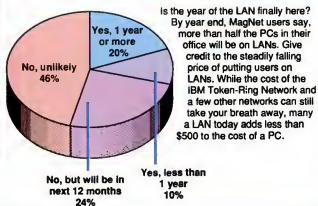
5. What floppy disk format predominates in your company?



8. Does your company plan to switch to OS/2 and OS/2 applications within the next 12 months?

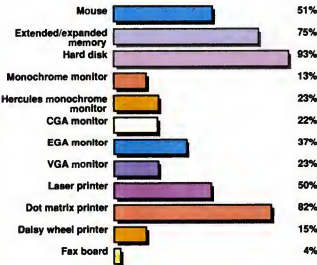


6. Are you on a network?

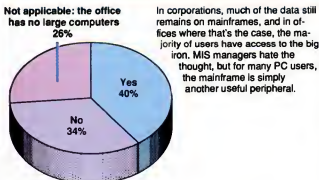


9. Which of the following types of equipment do you use with your computer at the office?

Hard disks are nearly universal now, and three-fourths of users have found use for more than the 640K that DOS was designed for. Half of all users have mice on their PCs, in recognition of the PC's increasingly graphical nature. Note that only a handful of users still have monochrome-only systems. While dot matrix printers are near-ubiquitous on individual desktops, half the users have access to a laser printer (more than one answer per category was possible). And if the Micro Channel architecture and 3 1/2-inch floppy disk drives haven't yet caught on in a big way, a quarter of all users have adopted one facet of the PS/2 specification set: higher-resolution VGA displays.



7. Is your PC connected to your office mainframe or minicomputer?



The BEST of 1988

COMPUTERS

IBM CORP. IBM PS/2 Model 70-A21

The Micro Channel architecture (MCA) bus design of certain members of IBM's PS/2 family has not been everybody's cup of tea. But even an avid coffee drinker has to tip his hat to the 25-MHz 80386-based PS/2 Model 70-A21 that IBM introduced last spring.

PS/2s have not been known for their outstanding performance, but the Model 70-A21 is different. IBM's normally conservative engineers rolled up their sleeves and modified Intel's standard

82385 cache controller chip to make it work with a 64K static RAM cache. All this componentry was then shrunk to fit inside the 221-square-inch cabinet originally designed for the sluggish Model 50. The result is a desktop powerhouse so small and effective it's almost irresistible.

Almost irresistible? Well, yes, the Model 70-A21 does have a couple of flaws. The 25-millisecond 160MB hard disk is not the fastest around, and it has only three MCA expansion slots. I became a little less concerned about these restrictions when I noticed Novell using a Model 70-A21 as a file server at the most recent NetWorld show in Dallas. But this limited expansion capability might crimp a power user's style.

The only other flaw I can think of is the A21's \$11,995 price tag. That's enough bread to buy a new family car. Or a Rolex, or maybe even all the tea in China. But I think you'd be better off buying the A21. —John Dickinson

FACT FILE: IBM PS/2 Model 70-A21; IBM Corp., Contact your nearest IBM dealer; (800) IBM-2468. **List Price:** With 2MB RAM,

1.44MB 3½-inch floppy disk drive, 120MB hard disk, \$11,295; 1MB Memory Module (85 ns.), \$695; 2MB Memory Module (85 ns.), \$1,395; 2MB Memory Module (80 ns.), \$1,495; 8512 VGA monitor (no card needed; basic configuration supports VGA), \$623; 80387 coprocessor, \$2,395; 150MB backup tape drive, \$2,095. **Reviewed:** November 15, 1988, page 110.

CIRCLE 667 ON READER SERVICE CARD

386 MEMORY MANAGEMENT

QUALITAS INC.

386-to-the-Max

You're sitting there with a nice new 386 accelerator board in your PC. But your data still wobbles through the old, slow RAM on your PC's motherboard. Or you bought a nice new 386 PC, with a meg of RAM on the motherboard, but you're irritated that you still can't use more than 640K of it with DOS. Or your favorite TSR utilities are taking up so much of your base 640K RAM that you're running out of space for your application programs.

It's *386-to-the-Max* to the rescue. By exploiting the clever memory-management tricks in the Intel 80386 microprocessor, *386-to-the-Max* solves all those problems and more. It also adds software emulation of the LIM EMS 4.0 standard, within the limits of any software-only scheme for supporting EMS 4.0. *386-to-the-Max* can free up otherwise-unused memory above 640K, giving you up to 704K of RAM for DOS applications. It can stick a handful of reasonably well-behaved TSRs up into that newfound memory. It can map your system's ROM calls into faster RAM, and move the typically



faster RAM found on most accelerator cards into the first 640K of memory, substantially speeding up program execution.

And it can do all this on virtually any PC that has an 80386 microprocessor and at least 256K (but preferably 1MB or more) of extended memory, while taking just 4K of base RAM.

For owners of 386 PCs, *386-to-the-Max* is surely the Utility of the Year.

—Jim Seymour

FACT FILE: *386-to-the-Max*, Version 4.0; Qualitas Inc., 8314 Thoreau Dr., Bethesda, MD 20817; (301) 469-8848. **List Price:** \$74.95; no-cost upgrade to Version 4.0. **Requires:** 1MB RAM, hard disk, 80386-based computer, DOS 3.0 or later. Not copy protected. **Reviewed:** January 12, 1988, page 43 (Version 1.94).

CIRCLE 670 ON READER SERVICE CARD

GRAPHICS

MICROGRAFX INC.

Graph Plus

One of the most shining applications running under *Windows* today is Micrografx's *Graph Plus*. The folks at Micrografx have been "doing *Windows*" since day one, and *Graph Plus*'s performance reflects their keen technical edge.

Graph Plus is an all-in-one business presentation



powerhouse, equally surefooted in both the drawing and chart/graphing realms. It also lays a strong foundation for a total Windows-based graphics solution. Use Windows' clipboard to combine your *Graph Plus* charts with the technical drawing capabilities of Micrografx's *Designer* and the well-executed selection of symbols in Micrografx's *Clip Art*, and

control over rotations, mirroring, and flipping, in increments of 1 degree.

Linear, exponential, and logarithmic regressions are built into the chart options. Those who think big can create giant graphics, as large as 12 8½-by-11½-inch pages, and then display the component pages together, in groups or individually.

Workaday graphics stum-



through the Windows clipboard, making this a good choice for both desktop publishing and graphics presentation environments.

Excel aficionados will delight as *Graph Plus* takes full advantage of DDE, allowing you to create a live data link from spreadsheet to graph.

Graph Plus is the closest thing to a Mac environment on the PC. And when the subject is graphics, that's a real compliment!

—Robin Raskin

FACT FILE: *Graph Plus*; Micrografx Inc., 1820 N. Greenville Ave., Richardson, TX 75081; (800) 272-3729, (214) 234-1769, in Tex. **List Price:** \$395. **Requires:** 512K RAM (640K recommended), graphics card supported by *Microsoft Windows* (EGA or VGA required for color), *Windows 2.0*, two floppy disk drives (hard disk recommended), DOS 2.0 or later. Not copy protected. Reviewed: September 27, 1988, page 136.

CIRCLE 688 ON READER SERVICE CARD

PERSONAL INFORMATION MANAGERS

ASKSAM SYSTEMS

askSam

You don't get ahead by standing still. *askSAM*, a top text-based information manager since 1985, has continually added features to remain at

the head of its class. In 1988 *askSam* also became a recognized leader in a new software category: Personal Information Managers (PIMs).

askSam lets you enter or import free-form information, which you access with simple or Boolean search requests. If it did nothing more, it would be great because *askSam* searches within and across files very quickly. But *askSam* is also a legitimate application development tool, suitable for automating single-user or department-standard data systems. The result is a two-level product, approachable for novices and casual users who just want to look something up, and also offering powerful potential for applications designers.

askSam is incredibly flexible. You can operate the pro-



gram by using menus or by command; files can be set up for free-form data entry, structured fields, or both. The dual-mode help system, using both context-sensitive help screens and a menu-driven help system, is a document file you can tailor for your purposes. A full-screen text editor and a report generator give you greater control of both video display and hard-copy output.

You can create and save program files for later execu-



GRAPH PLUS IS AN ALL-IN-ONE BUSINESS PRESENTATION POWERHOUSE, EQUALLY SUREFOOTED IN BOTH THE DRAWING AND CHART/GRAPHING REALMS.

you've got a robust, albeit memory-intensive, professional graphics environment.

Besides including a good selection of preformatted charts and chart enhancements, Micrografx gives you some unmatched power tools. Precision drawing primitives include curves, parabolas, polylines, and ellipses. These shapes can be smoothed and unsmoothed, curves can be fitted, and you can render 3-D effects for any surface, even specifying the depth. You have superfine

bling blocks, such as capturing your company's true logo colors on-screen, are no problem for *Graph Plus*. Four different color-mixing models can be used, and since it's easy to customize colors and palettes, the choices are virtually limitless.

Graph Plus is vector-based, which accounts for its success in producing large, smooth-looking output and provides a speedy on-screen edit. *Graph Plus* also supports the import of bit-mapped images and fonts

■ BEST OF 1988

tion with *askSam*'s command language. *askSam* also uses a hypertext function for creating menus; essentially any word on a data screen can be a menu item to refer to another screen or to execute a command file. Setting up hypertext menus and command files isn't simple, but the functional payback makes the effort worth it.

Some miscellaneous but can't-live-without-'em-after-you've-used-'em features include four-function arithmetic, a phone dialer, file encryption, and a password system to prevent unauthorized file changes.

askSam is a winner by virtue of its features, speed, and potential as an application development tool.

—Bruce Brown

FACT FILE: *askSam*, Version 4.1; askSam Systems, P.O. Box 1428, Perry, FL 32347; (800) 3ASK-SAM, (904) 584-6590 in Fla. List Price: \$295. Requires: 256K RAM, one floppy disk drive (hard disk recommended), DOS 2.0 or later. Not copy protected. Reviewed: December 13, 1988, page 102 (Version 4.01).

CIRCLE 600 ON READER SERVICE CARD

PRINTERS

APPLE COMPUTER INC.

Apple LaserWriter IINTX

In the LaserWriter's early days, few popular PC programs supported the strange new PostScript language and these even stranger serial printers. Much as PC users admired LaserWriter output, they generally had to connect the beast to a Macintosh to get

something usable on paper. Now, though, software support for PostScript and LaserWriters is commonplace in leading PC programs, and the LaserWriters have become the classiest output devices extant for PCs.



With 2MB of memory built in, and expandable to 12MB, the LaserWriter IINTX can handle all the downloadable fonts and complex pages desktop publishers can manage. Even better, though, the NTX has its own SCSI port and can accept its own dedicated hard disk for storing downloadable fonts. Thus, you won't have to clutter up your PC's hard disk with fonts or wait quite so long for the font-downloading process to be completed.

Apple's original LaserWriter, and especially its more capable successor, the LaserWriter Plus, were the unchallenged high-end leaders in the desktop laser-printer market. While HP's LaserJet went for volume, Apple remained true to its PostScript vision.

Now Apple has come out with the LaserWriter IINTX... simply the best printer that I've ever used,

period.—Jim Seymour

FACT FILE: Apple LaserWriter IINTX; Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014 (408) 996-1010. List Price: \$6,999; 1MB memory expansion kit, \$499; 4MB memory expansion kit,

the Personal Programmer application generator, "Quick Start" for dBASE and I-2-3 users, a dBASE conversion utility, built-in file and record locking, and wonderful documentation.

So, while Borland originally answered one paradox—how a sophisticated, state-of-the-art, multiuser DBMS can be simple and easy to use—why are there two different new versions of *Paradox*, and what exactly do they do?

By taking advantage of the 80386's 32-bit data path and ability to address all of your machine's memory, *Paradox* 386 can speed up activities like queries and sorts. *Paradox* 386 is terrific for off-loading the most power-intensive tasks to one machine in a workgroup. If the sheer throughput requirements demand you apply brute processing power to your database tasks, *Paradox* 386 will meet your demands.

If it's not as important to get a single job completed quickly as it is to have your computer available to pursue other tasks, then consider

\$2,399. Reviewed: October 31, 1988, page 116.

CIRCLE 600 ON READER SERVICE CARD

DATABASES

BORLAND INTERNATIONAL Paradox OS/2, Paradox 386

Paradox 386 and *Paradox* OS/2 offer the same robust command set and easy-to-use, I-2-3-like user interface that's found in *Paradox* 2.0 for DOS. Data tables, query results, deleted and modified rows—even the table's structure—are stored, accessed, and displayed as a series of rows and columns. Both newcomers feature the same sophisticated import/export routines as *Paradox* 2.0, and they dynamically update shared rows on the screens of other users. Both sport the PAL application language,



Paradox OS/2. By taking full advantage of OS/2's protected-mode operating environment, *Paradox* OS/2 lets you run more than one program simultaneously, including mul-

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CHRONOS SOFTWARE 1500 16th Street San Francisco, CA 94103

■ BEST OF 1988

multiple copies of *Paradox*. You can concurrently query or sort a table, or start new sessions from the *Paradox* menu. Time-consuming jobs can be run in OS/2 background sessions while you continue to interact with *Paradox* in the foreground. In addition, different *Paradox* sessions can pass data to one another, creating distributed applications that were once the sole domain of minicomputers and mainframes.

Want to throw the power of a 386 machine at a database problem? *Paradox 386* is the solution. Do you have a 286 or 386 and want a DBMS that takes advantage of the multitasking power of OS/2? Pick up *Paradox OS/2*. Who's the real winner? You are.

—Richard Hale Shaw

FACT FILE: *Paradox 386* and *Paradox OS/2*; Borland International, 1800 Green Hills Rd., Scotts Valley, CA 95066; (408) 438-8400. **List Price:** *Paradox 386*, \$895; upgrade from *Paradox 2.0*, \$125. *Paradox OS/2*, \$725. **Requires:** *Paradox 386*: 1.5MB RAM, one hard disk and one high-density 5¼- or 3½-inch floppy disk drive, 386-based computer, DOS 2.0 or later. Not copy protected. *Paradox OS/2*: OS/2 Standard Edition 1.0 or later, 3MB RAM, one hard disk and one high-density 5¼- or 3½-inch floppy disk drive, 286- or 386-based computer. Not copy protected. **Reviewed:** *Paradox 386*: June 14, 1988, page 33; *Paradox OS/2*: September 13, 1988, page 43. **CIRCLE 981 ON READER SERVICE CARD**

PERSONAL INFORMATION MANAGERS

LOTUS DEVELOPMENT CORP.

Agenda

Two types of information make the business world go round: corporate information

comprising regimented reams of client data, payroll histories, and parts numbers; and personal information involving notes jotted on business cards, brainstorming ideas, to-do reminders, and other wisps of potentially useful information.

To manage the latter kind of information, *Lotus Agenda* is just the ticket. *Agenda*, \$395, is the product that brought so much attention to the personal information



your information. When you review information, you can see it from different angles.



AGENDA'S MARKET SUCCESS MAY BE HAMPERED BY A FEROCIOUS LEARNING CURVE.

manager (PIM) category this year. The brainchild of Lotus founder Mitch Kapur, *Agenda* allows more structure than a word processor, more flexibility than an outline, more freedom from data size constraints than a database. You'd use *Agenda* to maintain an electronic notebook and to-do lists, and as a decision-making assistant.

As your database grows and *Agenda* begins to grasp your thought patterns, it can help you categorize and link

For example, with a to-do list, you could view your information grouped by date, by priority, by people you're dealing with, and by the projects you're working on.

Agenda's market success may be hampered by a ferocious learning curve. You can do many things well in an hour or two, but mastery might require hundreds of hours. Too bad, because *Agenda* could bring true productivity to millions of businesspeople who now have lit-

tle reason to put PCs on their desks.—Bill Howard

FACT FILE: *Agenda*; Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500. **List Price:** \$395. **Requires:** 640K RAM, hard disk, DOS 2.0 or later. Not copy protected. **Reviewed:** December 13, 1988, page 98. **CIRCLE 985 ON READER SERVICE CARD**

AFTER HOURS

MICROSOFT CORP.

Flight Simulator

Nothing you can buy for your PC can give you the feeling of flying like Microsoft's newly revamped *Flight Simulator*. If you liked the old *Flight Simulator*, you'll love the new one. Version 3.0 combines the best features of Microsoft's original *Flight Simulator* with a wealth of new ones to make it the hottest entertainment product of the year.

Flight Simulator 3.0 is more than just a game: it's a simulation in every sense of the word. Take a seat in front of your keyboard, and you're at the controls of a fully instrumented Cessna 182, with everything you need to practice flying under VFR or IFR conditions. More than 100 airports grace the terrain in five major metropolitan areas. One moment you can be testing your skills flying between the twin towers of the World Trade Center, and the next be on a steep glide over the waters of San Francisco Bay. And if you tire of the Cessna, the press of a key or a click of the mouse will land you in the cockpit of a sleek Gates Learjet or a Sopwith Camel.

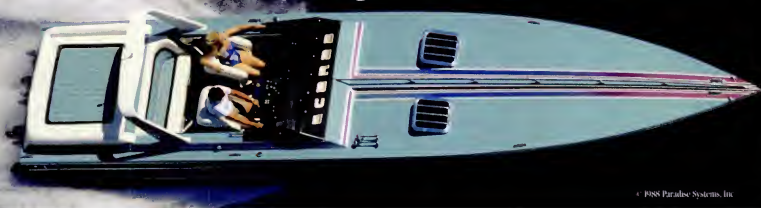
Flight Simulator 3.0 adds a number of long-overdue enhancements such as support

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You also get 256 brilliant on-screen colors with 640 x 400* resolution. Or 16 colors in 800 x 600 resolution, for even crisper detail.

Plus you get complete hardware and software compatibility, including downward

compatibility with all pre-VGA standards. And the Paradise VGA Plus 16 card comes complete with a long list of software drivers to support all your favorite programs.

In simple terms, it's the best high performance value going. At only \$499 retail.

For more information on any member of the Paradise VGA family—VGA Plus 16, VGA Plus™ or VGA Professional™—please call Paradise at (415) 960-3360. Or call the dealer nearest you.

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Western Digital Imaging

Western Digital Imaging/Paradise, 800 E. Middlefield, Mountain View, CA 94043



■ BEST OF 1988

for 16-color 640-by-350 graphics, pull-down menus, multiple views from both inside and outside the plane, and the ability to link several players together. A new entertainment menu offers predefined flight modes that let you run an airborne obstacle



course, land on an aircraft carrier's flight deck, play tag with an elusive chase plane, and more. It automatically records your flights in a logbook and provides colorful charts analyzing your crashes. And with the removal of copy protection, *Flight Simulator* can be installed on a hard disk.

Flight Simulator 3.0 stands heads above anything else in its field. Realtime 3-D computer graphics technology borrowed from state-of-the-art military and commercial aircraft simulators is the cornerstone of its success. If you haven't tried it, don't miss it; if you have, you're sure to agree there's nothing else that can touch it.

—Jeff Prossie

FACT FILE: *Flight Simulator*, Version 3.0; Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073-9717; (206) 882-8080. **List Price:** \$49.95. **Requires:** 256K RAM; CGA, EGA, MCGA, VGA, or Hercules Graphics Adapter; DOS 2.0 or later. Not copy protected. **Reviewed:** October 31, 1988, page 508.

CIRCLE 683 ON READER SERVICE CARD

COMMUNICATIONS SOFTWARE

RELAY COMMUNICATIONS INC.

Relay Gold

Relay Gold has always been a rock-solid and dependable program, each new release adding useful features while maintaining a simple function-key menu structure. The result is a program that is easy enough for the fumble-fingered novice but sophisticated enough for the most knowledgeable communications expert.

If you don't know anything about communications, *Relay Gold* is a good choice.

in the program's context-sensitive help.

For power users, *Relay Gold* is an even better choice. It offers a sophisticated script language, a learn mode, an unattended operations feature, and a manual that is chock-full of suggestions for how to take advantage of these features.

Relay Gold, Version 3.0, offers background operation and multisession capability. Use the 3270 emulation to sign on to your mainframe, and you can jump between mainframe and PC application program at the touch of a hot key. Or you can transfer files with another PC in the background while working on a program in the fore-



choice of Xmodem, Xmodem-CRC, Kermit, and *Relay*'s own file transfer protocol, which now includes a data compression feature.

There isn't much you could want in a communications program that you won't find in *Relay Gold*. At a list price of \$295, it's expensive for a communications program, but it's worth every penny. —M. David Stone

FACT FILE: *Relay Gold*, Version 3.0; Relay Communications Inc., 41 Kenosia Ave., Danbury, CT 06810; (800) 84-RELAY, (203) 798-3800 in Conn. **List Price:** \$295. **Requires:** 192K RAM, two floppy disk drives, DOS 2.0 or later. Not copy protected. **Reviewed:** July 1988, page 179 (*Relay Gold*, Version 2.0).

CIRCLE 674 ON READER SERVICE CARD



**RELAY GOLD IS EASY ENOUGH
FOR THE FUMBLE-FINGERED NOVICE
BUT SOPHISTICATED ENOUGH
FOR THE MOST KNOWLEDGEABLE
COMMUNICATIONS EXPERT.**

You can load the program and find your way through the menus without ever cracking the manual. If you run into anything you don't understand, you'll find the answer

ground.

The laundry list of features is long, so I'll mention only that *Relay Gold 3.0* supports several popular high-speed modems and it offers the

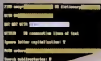
DEVELOPMENT TOOLS

THE PERISCOPE COMPANY INC.

Periscope III

No matter what your debugging needs, a single call to the Periscope Company has always sufficed. With the introduction this year of the *Periscope III*, the price of real-time, hardware-assisted debugging has been brought down below \$1,000.

The Periscope line of



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Vq finds disk information fast, no matter how it's formatted. You don't have to index or restructure your data to retrieve it. Just describe what you want, in plain English, and it's on your screen—*fast*! Then edit it with *Vq*'s full-featured editor, or call up your own word processor, compiler, or custom macro for processing.

It's easy to define complex searches, in natural language or as regular expressions. You can find all this year's mail-order customers, or you can find just those who ordered encyclopedias or dictionaries but not atlases. You can even "fuzzy search" if you're not sure how to spell encyclopedia.

Vq will search one or more files or directories, or a whole disk, to show you all the files which contain the target information. You can look at each hit in each file, highlighted in full context, to find what you need.

When you've found it, call up your application program to process it, or use *Vq*'s own powerful editor. Its features and flexibility expand your creativity into a screen-full of windows, for different files or different views of the same file. Compare files, edit them in parallel, or copy-and-paste to a new file—*Vq* makes it easy!

Best of all, *Vq* is fault-tolerant. While you're working, Auto-save is working too, so you can start each session where the last one ended—even if it ended unexpectedly!

Vq's macros make it easy to add its retrieval and editing power to the applications you're using now. You can call up a program and pass it a file with a Hot Link, or create your own library of custom sequences to invoke with a keystroke. You can find and edit a document before passing it to your desktop publisher, or even Compile and Display Next Error!

Vq doesn't complicate your life. It just adds what's been missing—fast free-form retrieval with integral multi-window editing, for *your* files and programs.

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and
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**EDITOR'S
CHOICE**

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DATA-286 12MHz

80286 running at 8/12MHz, 0/1 wait state
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Socket for 80287-8, -10
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
Floppy/hard disk controller
(1:1 interleave controllers available)
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

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"Marvelously cheap, powerful
alternative ... outperformed the
other 286's ..."

(October 11, 1988)



Portacom II

80286 running at 8/12MHz, 0/1 wait state
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Socket for 80287-8, -10
Real-time clock with battery backup
1.44MB 3.5" floppy disk drive
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102-key keyboard with "click"
Supertwist backlit LCD, 640x400 res.
RGB/monochrome output port
Weights under 20 Lbs.
1.2MB external floppy drive opt.
Carrying case available

\$1975



DATA-286 20MHz

80286 running at 10/20MHz
AWARD BIOS std.
1MB of RAM, exp. to 2MB on board
EMS 4.0 support for memory over 1MB
Socket for 80287
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
1:1 interleave floppy/hard disk controller
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

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Five 16 and two 8-bit slots
Mono card and monitor **\$1995**



Portacom I

80286 8/12MHz, 0/1 wait
Phoenix BIOS std. (Award opt.)
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200W power supply
1.2MB 5.25" floppy drive
20MB hard disk drive
Supertwist backlit LCD
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A PREFERRED COMPUTER SYSTEM

DATAWORLD

products includes a software-only debugger (the Periscope II-x), a board with a breakout switch (the Periscope II), a protected-memory board with a breakout switch (the Periscope I), and now the Periscope III hardware breakout board. All products hold true to a consistent user interface. No pretty windows to distract you from the task at hand unless you want them—the screen display is totally configurable according to the hu-

cords that Microsoft compilers include for Codeview debugging, allowing for full symbolic debugging of even local parameters declared on the stack. This is a must for programmers of high-level languages, such as C.

Based on an absurdly low price, great performance, functionality, ease of use, and phenomenal support, the Periscope III is most assuredly a winner.

—Ross M. Greenberg



man debugger's tastes.

The Periscope III allows you to trap errors in real-time, which would be difficult, if not impossible, to catch with most other debuggers. Debugging a device driver? Pointers askew, or an interrupt vector pointing to memory on a computer sitting in the other room? The Periscope III makes it easy to catch the buggy instruction in the act and to exterminate it quickly and effortlessly.

Backtracing based upon the instructions available on the bus—including the prefetch queue—is great for shaving a few clock cycles off your code as well as pinpointing where your code might have gone astray.

The Periscope III can now utilize the special debug re-

FACT FILE: Periscope III, Version 4; The Periscope Company Inc., 1197 Peachtree St., Plaza Level, Atlanta, GA 30361; (800) 722-7006, (404) 875-8080, in Ga. **List Price:** \$1,395. **Requires:** 128K RAM, one floppy disk drive, DOS 2.0 or later. **Not copy protected. Reviewed:** August 1987, page 43 (Version 3, Models I, II, II-x).

CIRCLE 600 ON READER SERVICE CARD

LAN OPERATING SYSTEMS

NOVELL INC. SFT NetWare

When you look at the category of local area network products, you must look beyond the product itself. A flawed word processing product is an irritation, but a flawed network product can be an orga-



nizational disaster waiting to happen.

A network provides very little by itself: compatible products that operate on the network must be available and interconnection standards must be supported.

Although there are many LAN operating systems on the market, our testing in the *PC Magazine* LAN Labs clearly shows that one stands above the rest in performance, features, and support. Novell's *SFT NetWare*, Version 2.1, is the clear choice of network buyers and our editors.

Novell's product isn't perfect. Many competing products cost less and are easier to install and easier to administer. But *NetWare* is reliable, rich in features, and well supported. So many highly technical people use and depend on *NetWare* because it is the all-around best of its class. *NetWare* is so sturdy and flexible that many companies other than Novell sell *NetWare* companion and compatible products.

Novell's *NetWare* has a list of features, fast performance, a dealer base, training opportunities, and a support organization that its challengers only dream of. Novell's *SFT NetWare*, Version 2.1, is the best of today's constantly improving and highly competitive crop of local area network products.

—Frank J. Dierler, Jr.

FACT FILE: *SFT NetWare*, Version 2.1; Novell Inc., P.O. Box 5900, Provo, UT 84601; (801) 379-7808. **List Price:** \$4,695 for 100-node system. **Requires:** 80286- or 80386-based server, 512K RAM in the server (additional memory recommended) and 192K RAM in each workstation, hard disk, DOS 2.0 or later. **Not copy protected. Reviewed:** June 14, 1988, page 156.

CIRCLE 673 ON READER SERVICE CARD

C A D D

CADKEY INC.

Cadkey

Cadkey is one of the first PC-based CADD systems to achieve—and even exceed—full large-system functionality and performance in 3-D. It is a problem solver's system, with enough power to do almost anything a mechanical designer can dream of—without the designer's having to become an ace programmer. *Cadkey*, Version 3.02, has no superfluous arcana, just an honest and robust set of tools for getting the job done.



Wonderfully open and cooperative, *Cadkey* makes it a simple matter to access any of its routines and your data. And if all you want to do is use CADD, this power comes wrapped in a human-like interface that is as friendly, responsive, and consistent as anything on the PC in 1988.



CADKEY 3 HAS NO SUPERFLUOUS ARCANA, JUST AN HONEST AND ROBUST SET OF TOOLS FOR GET- TING THE JOB DONE.

Cadkey's procedural language, CADL, puts the full power of *Cadkey* under the control of programs you write. CADL can also be used to define additional commands that integrate seamlessly into the program. While other CADD programs have procedural languages of their own, CADL is particularly effective.

Cadkey is especially strong in the area of 3-D modeling—you can derive eight views from a single model.

The documentation and training materials are well done and do what they purport to do. *Cadkey* is a sound, mature, workmanlike product—and an excellent value. —Joel N. Orr

FACT FILE: *Cadkey*, Version 3.02; Cadkey Inc., 440 Oakland St., Manchester, CT 06040-2100; (203) 647-0220. List Price: \$3,195. Re-

quires: 640K RAM, hard disk, graphics card, DOS 2.0 or later. Copy protected. Reviewed: August 1988, page 134. CIRCLE 697 ON READER SERVICE CARD

COMMUNICATIONS SOFTWARE

DATASTORM TECHNOLOGIES INC. ProComm Plus

Just as networks didn't give us the paperless office, communications programs don't always help people communicate. Too many people have been intimidated by menus full of "Xon-Xoff" and "full or half duplex" choices. "Hey, if I want to look at duplexes, I'll call a real estate agent," they say. And so countless modems will never hear their master's AT command.

Fortunately, thousands have stumbled across *ProComm*. For many, the discovery was made on a bulletin board where on a long list of shareware they spied a listing annotated by the SysOp with a comment like "great comm program; must see."

The legend grew under the shareware umbrella, helped in no small part by the accessibility of its creators, Bruce Barkelew and Tom Smith, who've worked with other shareware authors to establish high standards for shareware programs. This year they launched a commercial version of the program, *ProComm Plus*, while keeping *ProComm 2.4* a shareware package.

ProComm Plus is all the better for its shareware roots; it comes with hundreds of BBS phone numbers and their settings in ready-to-use directories. Its host mode is so complete that you could easily start your own bulletin board. It has a fairly complete script language with conditional branching and file I/O, and the program will auto-record communications sessions to create scripts. And when its authors decided *ProComm Plus* needed a new directory and script structure, they were close enough to their audience to know they needed to provide conversion utilities at no charge.

Crosstalk Mark IV and *Smartcom 4* have more-powerful script languages, to be sure. But *ProComm Plus* has more than enough power for most people, and like a carefully crafted tool, it puts the right features just where you'd want them to be. It removes the barriers from communications.

—Gus Venditto



FACT FILE: *ProComm Plus*, Version 1.1B; Datastorm Technologies Inc., P.O. Box 1471, Columbia, MO 65205; (314) 474-8461. List Price: \$75. Requires: 192K RAM, two floppy disk drives, DOS 2.0 or later. Not copy protected. Reviewed: July 1988, page 160 (Version 1.0). CIRCLE 677 ON READER SERVICE CARD

FINANCIAL SOFTWARE

INTUIT Quicken

Intuit's *Quicken* goes beyond the miser's obsession with where all the money went. Appealing to the opposite impulse, it helps you to spend—intelligently, not frivolously.

You get your first experience of *Quicken's* intelligence when you fill out a bank check: the software writes out the dollar amount in words once you've typed the sum in numbers, and the space allotted to the optional address is perfectly positioned to show through the windowed envelopes Intuit sells with the program.

The checks you type can be printed then and there to a dot matrix or laser printer on checks cleverly designed to align properly in the printer, or you can print later in batch mode. In either case, any check can be seamlessly recorded with a simple key-

COMPAQ® H-P® IBM® SUN® TANDY AND UNISYS® ALL HAVE A POWERFUL WEAPON.



In the computer industry, every manufacturer wants to build their machines so fast, powerful, and easy to use that it gives them an edge on the competition. So at first, it seems surprising that these intense competitors all use the same chip: Intel's 386™ microprocessor.

But when you think about it, this chip not only gives their machines blazing performance. It's

also fully compatible with the broadest range of software available today, and the software that's coming tomorrow. Which is why the 386 chip has become the common denominator in computing.

So if you're buying a new computer, make sure it has an Intel 386 chip inside. Because in today's tough business environment, it's good to know the ultimate weapon is sitting on your desk.

The Intel logo, consisting of the word "intel" in a lowercase, sans-serif font, with a small registered trademark symbol (®) to the upper right.

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CIRCLE 512 ON READER SERVICE CARD

stroke combination in *Quick-*
en's check register.

The check register also looks familiar, with columns for date, check number, payee, and so on. But unlike

ment. Assign categories of your own devising to your checks, and *Quicken's* Report menu supplies the brains to turn those categories into canned reports. Small busi-

true crossover software—a financial program for both personal and small-business use. —Paul B. Ross

FACT FILE: *Quicken*, Version 2.0; Intuit, 540 University Ave., Palo Alto, CA 94301; (800) 624-8742, (800) 468-8481 in Calif. List Price: \$49.95; checks, \$39.95 for 500; window envelopes, \$29.95 for 500; Lotus transfer utility, \$19.95. Requires: 256K RAM, DOS 2.0 or later. Not copy protected. Reviewed: December 27, 1988, page 372.

CIRCLE 675 ON READER SERVICE CARD



INTUIT'S QUICKEN GOES BEYOND THE MISER'S OBSESSION WITH WHERE DID ALL THE MONEY GO. APPEALING TO THE OPPOSITE IMPULSE, IT HELPS YOU TO SPEND—INTELLIGENTLY, NOT FRIVOLOUSLY.



manual registers, this one is smart, doing all the math for you while you're entering checks or reconciling the register and your bank state-

nesses can do payables, petty cash, payroll, and more.

Now export the check register's numbers to a Lotus 1-2-3 spreadsheet with *Quicken's* optional export utility, and you tap into some very powerful financial analysis capabilities indeed.

The intelligence of *Quicken's* design and its ability to move you seamlessly from the familiar world of manual record-keeping to the electronic blitz of 1-2-3 give it the makings of a single-entry accounting system and crown it

DESKTOP PUBLISHING

XEROX CORP.

Ventura Publisher

Even without the enhancements of Version 2.0, *Ventura Publisher* stands by itself in the MS-DOS desktop publishing world. *Ventura* can handle a broad range of tasks, from the single-page flyer to the full-length book or manual. It can use material produced with nearly any word processor or graphics program. And its design permits graphic creativity while imposing enough restraint to encourage you to be consistent in designing related documents.

Ventura is as broad-minded about hardware as it is about software. It works comfortably with PostScript printers, as well it should, but is equally at home with HP LaserJets and other printers. Based on the GEM interface, it supports a wide range of display adapters. And unlike many Microsoft Windows-based programs, it performs with adequate speed on a lowly 4.77-MHz XT. If you in-

sist on *Windows*, *Ventura* will run there too.

Version 2.0 expands on the program's existing strengths. You can combine multiple text files into a single file, even if they are in different formats, which you then save in one file in your choice of format. You get finer control through features like on-screen manual kerning, hundredth-of-a-point precision, and flexibility in placement of headers and footers on custom-sized pages.

You get more creative support as well. How about 90-, 180-, and 270-degree rotation of text (provided your printer can do it)? *Ventura* can now print color separations—a separate page for each of up to six colors per document. And you choose between a palette of 62 million colors! You also get a



free bundle of Bitstream Fontware soft fonts.

The new *Professional Extension* makes use of expanded memory for large documents, handles scientific and mathematical equations, and easily produces forms from worksheets and tables.

Speed, power, and grace all in one package. If you need to make a good impression through the printed page, you can count on *Ventura* to do the job. —Alfred Poor

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for buying our new LaserJet IID printer
is on the other side of this page.

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for buying our new LaserJet IID printer
is on the other side of this page.



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The LaserJet IID printer is full of new ideas for making paper-handling easier and more efficient.

An envelope feeder accessory, for one. Instead of having to feed envelopes manually, our new printer does it automatically.

You wanted more paper trays. So the LaserJet IID printer has two of them, each with a 200-sheet capacity. Give us more fonts, you said. And LaserJet

Series II compatibility. Done!

So now you have a choice of two HP LaserJet printers. Both with that superb quality for text and graphics you've come to expect from Hewlett-Packard.

All good reasons to call 1-800-752-0900, Ext. 297A for the name of your nearest dealer.



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PACKARD**

BEST OF 1988

FACT FILE: *Ventura Publisher, Version 2.0;* Xerox Corp., Xerox Square, P.O. Box 24, Rochester, NY 14692; (800) TEAM-XRX. **List Price:** \$895. **Requires:** 512K RAM (640K RAM recommended), hard disk, mouse, graphics card, DOS 2.0 or later. Not copy protected. **Reviewed:** December 27, 1988, page 130.
CIRCLE 669 ON READER SERVICE CARD

COMPUTERS

COMPAQ COMPUTER CORP.

Compaq 386 line

While IBM sells more PCs, Compaq holds the reins of leadership among the machines that count: 80386-based PCs. Ever since it rolled out the first 16-MHz Deskpro 386 in September 1986, Compaq has been driven to push the performance envelope of the desktop 80386-based PC. It's Compaq, not IBM, that has been first to market with 16-MHz, 20-MHz, and 25-MHz 386s, the 16-MHz 386SX desktop PC, and the 20-MHz lunch-box Portable 386.

And Compaq has never produced a machine with crippled capabilities so that it

wouldn't overshadow a more expensive member of the line. You won't see a Compaq that restricts you to 2MB

ing 286 processor. Combine that with the market's continued uncertainty about the here-and-now benefits of



WHILE IBM SELLS MORE PCs, IT'S COMPAQ THAT HOLDS THE REINS OF LEADERSHIP AMONG THE MACHINES THAT COUNT: 80386-BASED PCs.

of memory or a 20MB hard disk, and you won't see nostalgic efforts to wring a few extra megahertz out of the dy-

Micro Channel, and you have cogent reasons why Compaq is the dominant force in PCs today.

Compaqs aren't cheap, but Compaq understands the premium that business users place on compatibility and reliability. When segments of the market become overly price sensitive, Compaq bids them adieu, as it did to its 16-MHz and 20-MHz wide-body 386s when it brought out the small-footprint 386/20e in September. —Bill Howard

FACT FILE: *Compaq 386 line;* Compaq Computer Corp., 20555 FM 149, Houston, TX 77070; (713) 370-0670. **List Price:** *Compaq Deskpro 386S;* with 1MB RAM, 1.2MB floppy disk drive, Compaq enhanced

keyboard, \$3,799; with 20MB hard disk, \$4,499; with 40MB hard disk, \$5,199. *Compaq Deskpro 386/20e;* with 1MB RAM, 1.2MB floppy disk drive, Compaq enhanced keyboard, \$5,199; with 40MB hard disk, \$6,599; with 110MB hard disk, \$7,999. *Compaq Portable 386;* with 1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, \$7,999; with 100MB hard disk, \$9,999. *Compaq Deskpro 386/25;* with 1MB RAM, 1.2MB floppy disk drive, 60MB hard disk, Compaq enhanced keyboard, \$8,299; with 110MB hard disk, \$10,299; with 300MB hard disk, \$13,299. **Reviewed:** *Compaq Deskpro 386S;* August 1988, page 93; *Compaq Deskpro 386/20e;* October 31, 1988, page 33; *Compaq Portable 386;* October 11, 1988, page 100; *Compaq Deskpro 386/25;* September 13, 1988, page 36.
CIRCLE 666 ON READER SERVICE CARD

EQUATION SOLVERS

MATHSOFT INC.

MathCAD

MathSoft aptly describes *MathCAD* as "an electronic scratchpad for scientists and engineers." But *MathCAD* is a superb tool for quick calculations of considerable sophistication.

Suppose you want to compute a double integral over a nonrectangular region. With another capable package, you'll find yourself reaching for the manual to figure out the syntax needed to express an integral, its limits, and integrand. With a keystroke combination, *MathCAD* presents integral signs with placeholders for the limits, integration variable, and integrand—just as you'd see on paper. This familiar metaphor makes it a breeze to set up problems.

MathCAD includes a large collection of built-in functions and constructs. Arrays and matrices are part of its vo-



■ BEST OF 1988

cabulary, and it can solve sets of nonlinear equations (but not differential equations). It knows about Bessel functions and error functions, in addition to the standard trigonometric functions. *MathCAD* can compute correlation coefficients as well as standard deviations on data sets, and it can find spline approxima-



tions and fast Fourier transforms. It's also easy to imbed function plots in the middle of text and formulas.

While *MathCAD* is the best of its type, it is not without its flaws. I find its equation editing very unintuitive and its speed of calculation considerably slower than a program like *Gauss*. But it may not matter that *MathCAD* takes 20 seconds rather than 5 to compute something if it takes 5 minutes to set up in *MathCAD* and 20 in another program.

MathCAD requires a graphics monitor and supports a wide variety of output devices. If you need more from a calculator than four functions but are willing to go elsewhere for your number crunching, you'll find *MathCAD* an essential tool.

—Barry Simon

FACT FILE: *MathCAD*, Version 2.0; MathSoft Inc., 1 Kendall Sq., Cambridge, MA 02139; (800) MATHCAD, (617) 577-1017 in

Mass. List Price: \$349. **Requires:** 512K RAM, graphics card, DOS 2.0 or later. Not copy protected. **Reviewed:** March 15, 1988, page 43. **CIRCLE 984 ON READER SERVICE CARD**

MASS STORAGE

PLUS DEVELOPMENT CORP.

Plus Passport

The Plus Passport stands as a shining example of a product done right. It gives you not only what you'd demand in a removable hard disk—a fast, dependable mechanism in a durable, down-sized cartridge—but also a handful of features you wouldn't have thought to request.

The Passport borrows a large portion of its design from Plus's popular HardCard, including the HardCard's 40-millisecond, 40MB Winchester disk. The RLL controller, complete with a full-track buffer, runs the disk at a 1:1 interleave, making the disk perform more like a 28-ms drive. Plus's Airlock head-parking technology avoids head crashes even during sudden power loss.

The disk mechanism is completely contained within a



2.4-pound casing the size of a VHS tape case. The disk motors in and out of its external or half-height internal receptacle much as a videotape moves in and out of its player.

But the features that elevate the Passport above its competition don't have anything to do with its size, speed, or durability; they have everything to do with making it a versatile and practical removable hard disk.

For instance, a boot selection switch on the rear of the unit lets you override the hard disk configuration of your system. This feature, a real plus if you need to boot your system under OS/2 or Xenix every now and then, allows you to reassign the Passport as the C: drive, relegating your original boot drive to another designation.

A write-protect switch and an optional battery holder, which supplies backup power to the Passport's eject mechanism in the event of system power failure, also help elevate the Passport to its Best of 1988 stature. —Mitt Jones

FACT FILE: *Plus Passport*; Plus Development Corp., 1778 McCarthy Blvd., Milpitas, CA 95035; (408) 434-6900, (800) 826-8022 for technical information. List Price: Base

housing with adapter, \$659; external chassis, \$399; Micro Channel bus PS/2 unit, \$759; 20MB disk, \$595; 40MB disk, \$795. **Requires:** IBM PC, XT, AT, or compatible and DOS 3.0 or later; or Micro Channel bus-based computer and DOS 3.3 or later. Supports OS/2. **Reviewed:** September 13, 1988, page 258. **CIRCLE 978 ON READER SERVICE CARD**

WORD PROCESSING

WORDPERFECT CORP.

WordPerfect 5.0

The best way to find out what makes *WordPerfect* 5.0 the best word processor of the year is to pick a function key at random and find out what it does.



Choose the Print key, for example, and try out *WordPerfect*'s amazingly fast print-preview, with graphics and special characters displayed in exact scale. From the same key, try the menu that lets you match sheet feeder bins with different sizes or types of forms. Or the menu that lets you select soft fonts for automatic downloading when you need them, or pick a print job and push it to the top of the queue.

Pick the Styles key to use style-sheet formats that can include boilerplate text, and that stay with a document

It Takes Guts To Turn A Laptop Into A Desktop.

Most desktop computers are entirely too big and too clumsy to make it off the desk, to say



Two IBM-compatible internal expansion slots let you expand the T3200's capabilities quickly and easily.

nothing of making it out of the office.

But with the lightweight portable Toshiba T3200, that's no longer a problem.

We've squeezed everything you'd expect from a powerful desktop computer into a light, slender 19-pound portable — packaged to go.



A separate numeric keypad speeds data entry.

It has two built-in IBM-compatible expansion slots for networking and mainframe communications. A 12MHz 286 microprocessor for high-speed data handling. A 40MB hard disk for quick, easy access to all your applications. A

720KB, 3½" diskette drive. And a full megabyte of RAM that's expandable to 4MB for

The T3200 is backed by the Exceptional Care Program (no cost enrollment required). See your dealer for details. IBM is a registered trademark of International Business Machines Corporation.

memory that can rival even the most muscular desktops around.

It even comes with a built-in EGA gas plasma display and an EGA monitor port — standard features that some desktops



A 12MHz 80286 microprocessor helps speed data handling.

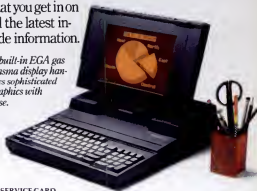
consider optional extras. Yet, it gives you the freedom to go anywhere your work takes you — from your boardroom to your living room.

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A built-in EGA gas plasma display handles sophisticated graphics with ease.



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Toshiba America Inc., Information Systems Division

BEST OF 1988

when you move it to another computer. Or choose the List Files key and get instant access to a full-featured file manager built into the program. Or check out the Mark Text key with its automatic cross-referencing.

you can remap the entire keyboard with special characters or macros and switch from one keyboard to another with a keystroke. And the same key lets you choose special screen fonts that give you fast, text-mode underline or



WORDPERFECT IS DESIGNED TO LET YOU SIT DOWN AND WRITE WITHOUT DISTRACTIONS, WHILE IT QUIETLY DEPLOYS ITS TECHNICAL WIZARDRY IN THE BACKGROUND.

You can press the Font key and select fonts either by name or by choosing a relative size and letting the program choose the right fonts for you. Or you can explore the Graphics key that lets you import images in virtually any format, then resize or rotate them, put them in boxes, enumerate them in lists, and anchor them to specific text or anywhere in a paragraph or page.

If you look into the Setup key's capabilities, you'll find

italic in VGA or any of 512 characters with a Hercules card.

But what's best of all about *WordPerfect 5.0* is that you don't need to explore any special keys to enjoy its smooth, intuitive operations. More than any other word processor, *WordPerfect* is designed to let you sit down and write without distractions, while it quietly deploys its technical wizardry in the background.

—Edward Mendelson

FACT FILE: *WordPerfect*, Version 5.0; WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; (801) 225-5000. List Price: \$495. Requires: 384K RAM (512K recommended), two floppy disk drives (one floppy disk drive and one hard disk recommended), DOS 2.0 or later. Not copy protected. Reviewed: November 29, 1988, page 117.

CIRCLE 666 ON READER SERVICE CARD

DISK CACHING SOFTWARE

SOFTWARE MASTERS INC.

Flash V Disk Accelerator

It has been an uphill climb, but caching has moved into solid respectability in the PC marketplace. Caching software is now bundled with computers from IBM, Apple, Compaq, Dell, and HP. Version 6.0 of *Flash V Disk Accelerator*, one of the older PC caching packages, is a major upgrade and ups the ante again.

Flash, from Software Masters, gives you total control over the selection of its many features, although its automatically generated configuration can control the caching process for you. You can merge conventional, extended, and expanded memory into a single cache. *Flash* will save a current cache configuration, allowing you to keep different configurations for different applications. If you know that you will be accessing certain files often but not consecutively, you can force them to remain in cache. Software Masters also provides a RAMdisk that dynamically sizes itself to fit the data loaded, leaving the rest of the



memory pool to *Flash*.

Flash can buffer writes, speeding up operation further, and it does everything that it can to avoid problems. If you remove a floppy disk or cartridge before it is updated, *Flash* will inform you, and if you try to Ctrl-Alt-Del before a write has been executed, *Flash* will stop the system from rebooting.

Flash, Version 6.0, is fast and full-featured. It is one of the least expensive ways to get better performance out of the system you already have.

—Philip F. H. Rose

FACT FILE: *Flash V Disk Accelerator*, Version 6.0; Software Masters Inc., 6352 N. Guilford Ave., Indianapolis, IN 46220; (317) 253-8088. List Price: \$69.95; upgrade, \$25. Requires: 256K RAM, one floppy disk drive (two floppy disk drives or one hard drive recommended), DOS 2.0 or later. Not copy protected. Reviewed: November 24, 1987, page 238.

CIRCLE 681 ON READER SERVICE CARD

PRINTERS

HEWLETT-PACKARD COMPANY

Hewlett-Packard LaserJet IID

Hewlett-Packard's printer division has done it again: first the original LaserJet (1984) that sounded the death knell for daisy wheel printers, then

WHAT YOUR ACCOUNTANT MIGHT NOT WANT YOU TO KNOW*

* **Andrew Tobias' Tax Cut lets you prepare a professional quality tax return yourself – even if you're a novice at tax preparation.**

All the features you need

Tax Cut automatically calculates and prints your completed 1040 return and up to 23 other IRS-approved forms and schedules. It finds the tax approach that saves you the most money: whether you should file jointly, itemize, take the zero bracket amount, and much more. It features an instant tax summary window that lets you see where you stand at any point in the program, and "What if" calculations on any form or schedule for important planning before year-end.

Works like an easy interview

Unlike other programs, Tax Cut "interviews" you in friendly layman's terms and without IRS jargon — the same way an empathetic accountant might. It uses your answers to automatically select the schedules you need, and then computes and prints your tax return based on current tax law. All you do is answer, sign and file!

You answer each question only once. Tax Cut automatically transfers the information to every line or schedule where it's needed, and performs computational checks to make sure your answers are consistent.

With Tax Cut, you need not see any IRS forms until the program prints your return. (If you do wish to review the forms on-screen, just use the easy display feature.)

Saves you valuable time

With Tax Cut, even the most complex tax returns rarely take more than one hour. Compare that to time-consuming trips to an accountant. Or treks through the January slush to get the proper forms from the IRS office. Or the time-burning tedium of mistake prone manual preparation, which has you transferring the same information from line to line and form to form.

Saves you money, too

Tax Cut helps you know what financial decisions to make, and when to make them, for maximum tax savings. It eliminates the mathematical errors that can result in overpayment. It checks to see that you don't pay more FICA than you should (a common mistake). And most important, with Tax Cut there's no more need to spend significant amounts of money for professional quality tax preparation you can easily do yourself.

Comprehensive yet simple

Tax Cut is written by a team of tax professionals and personal finance expert Andrew Tobias. Together, they bring you a program that is fully comprehensive and current, yet simple enough for even a tax novice.

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the Series II (1987) that boosted quality and slashed prices, and now the LaserJet IId with both-sides printing, font rotation, and two paper trays.

For duplex printing, the paper briefly exits the rear of the printer and flips over; rollers feed the paper back in for the second pass. You pay a slight speed penalty: 6.3 pages per minute vs. 7.5 ppm normally.

The new printer includes a 12-pitch Courier font and an optional envelope feeder. Any font can be rotated 90 degrees, so that every font you can print in portrait mode you can print in landscape, too. HP made the front-panel set-up a bit easier, although the reflective LCD remains hard to read. The price is more than competitive at \$4,295. Too bad HP has no plans to add the font rotation capability to the original Series II.

—Bill Howard

FACT FILE: Hewlett-Packard LaserJet IId; Hewlett-Packard Company, 19310 Princeton Ave., Cupertino, CA 95014; (800) 752-0900. List Price: \$4,295 Reviewed: Not previously reviewed in *PC Magazine*.
CIRCLE 888 ON READER SERVICE CARD

386 MEMORY MANAGEMENT

QUARTERDECK OFFICE SYSTEMS QEMM-386

Why should you spend good money on a 386 machine when almost every application program works perfectly well in a lesser computer? QEMM-386 is one good reason. Quarterdeck's \$59.95 80386 memory manager isn't an application program, but it helps your applications run faster and more efficiently.

QEMM-386 (like Qualitas's comparable memory manager, *386-to-the-Max*) loads memory-resident programs in otherwise unused extended memory, above the DOS-standard 640K. This

gives your applications more elbowroom for large files and means that they have to read the disk less often. It also means that you have room to run large applications and TSRs at the same time, as 80286-based machines never will.

But QEMM-386's main function is to transform extended memory into LIM 4.0 expanded memory, and QEMM's LIM emulation is the fastest available. QEMM also speeds BIOS operations and graphics cards by copying slow ROMs into fast RAM. It also tests the RAM in your system and reserves the fastest for the crucial 640K needed by DOS. And it occupies only 1.5K of standard DOS memory while performing all these feats.

Although QEMM-386 improves the already impressive multitasking talents of Quarterdeck's *DESQview*, you don't need *DESQview* to take advantage of QEMM-386. It works in any 386 system and automatically finds the right parameters for installation.

How does QEMM-386 compare with *386-to-the-Max*? Both are superb, reliable designs. The latest versions of both programs let you load device drivers as well as TSRs into high memory. They're both so inexpensive you could get both. But first get that 386.

—Edward Mendelson



FACT FILE: QEMM-386, Version 4.1; Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405; (213) 392-9851. List Price: \$59.95; upgrade from previous versions, \$19.95. Requires: 80386-based system, 640K RAM, hard disk, DOS 2.0 or later. Not copy protected. Reviewed: Not previously reviewed in *PC Magazine*.
CIRCLE 878 ON READER SERVICE CARD

DISK CACHING SOFTWARE

MULTISOFT CORP.

Super PC-Kwik

If the hot new machine you buy comes with caching software, chances are good that it uses *Super PC-Kwik* from Multisoft. This excellent caching software is bundled with Dell and HP machines, among others. *PC-Kwik*, Version 3, gives you exten-



sive control over your cache settings, from memory size and location to advanced handling features. And the program's manual will help you design optimized cache configurations for your applications.

Super PC-Kwik caches writes as well as reads and will not write out data to disk if it has not changed. It can be set to read whole tracks rather than single sectors, anticipating that you will want to read the rest of the track as well. This can speed up operations in spreadsheet and database programs, which often load large blocks of contiguous data.

Caching programs usually require you to give up a sizable chunk of conventional memory, even when you're using cache in extended

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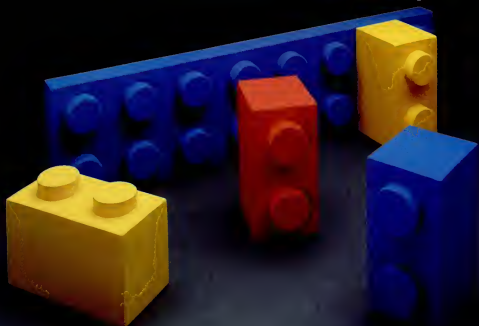
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Introducing SystemWyse™ Wyse PCs are themselves building blocks in a comprehensive system for creating solutions. They link effortlessly with our terminals, monitors, and expansion boards in integrated solutions of exceptional quality and value, using industry standard software. And SystemWyse is backed by the company that sells more terminals than anyone but IBM.



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CIRCLE 734 ON READER SERVICE CARD

■ BEST OF 1988

memory. You can load *PC-Kwik* into expanded memory if RAM is at a premium, reducing the conventional memory drain to 16K while sacrificing little performance. And Multisoft's print spooler will dynamically size itself to accommodate print jobs as they occur, sharing the same RAM with *PC-Kwik*.

As processors and memory have gotten faster, disk I/O has become a more serious bottleneck, and disk caching is almost a necessity. Whether you are using an old machine and want to do some catching up, or a new speed demon and want to blow the roof off, *Super PC-Kwik* will help you squeeze more performance out of what you've got.—Philip F. H. Rose

FACT FILE: *Super PC-Kwik*; Version 3; Multisoft Corp., 15100 SW Koll Pkwy., Suite L, Beaverton, OR 97006; (800) 274-5945, (503) 644-5644. List Price: \$79.95. **Requires:** 64K RAM, DOS 2.0 or later. Not copy protected. Reviewed: January 13, 1987, page 43. **CIRCLE 671 ON READER SERVICE CARD**



IBM OFFERS A VERITABLE WARDROBE OF OPTIONAL PAPER HANDLERS AND FONT CONTROLLERS, MAKING THE QUICKWRITER ONE OF THE BEST-DRESSED PRINTERS AROUND.

The Quickwriter was a standout in the crowd of 60 dot matrix printers we evaluated in the 1988 printer issue. It tested at an excellent 221.9 characters per second in draft mode, and at an even more impressive 80.7 cps in near-letter-quality mode. Few other 24-pin dot matrix printers can match these speeds. What

they can't match is the quality of the Quickwriter's output—it's among the sharpest we've ever seen from a non-daisy-wheel impact printer.

IBM also offers a veritable wardrobe of optional paper handlers and font controllers, making the Quickwriter one of the best-dressed printers around. The \$849 multiple-

bin cut-sheet and envelope feeder and the \$349 single-bin sheet feeder are both smooth operators. An EEPROM cartridge can hold up to four fonts in memory at a time, and a disk containing 29 fonts is available for \$50. IBM also sells 18 fixed-font cartridges for \$85 each to augment the four standard NLQ fonts. Standard memory is 8K, and a 32K printer buffer is a \$75 option.

Most dot matrix printers suffer from the debilitating speed vs. quality trade-off: if you want your output fast, it isn't pretty, and if you want your output pretty, it isn't fast. The Quickwriter isn't the cheapest 24-pin printer, but it proves that sometimes you can have it all.

—Donald P. Willmott

FACT FILE: *IBM Quickwriter Printer*; IBM Corp., Contact your nearest IBM dealer, (800) IBM-2468. List Price: \$1,699. Reviewed: October 31, 1988, page 285. **CIRCLE 688 ON READER SERVICE CARD**

PRINTERS

IBM CORP. IBM Quickwriter

These days, all the excitement in the printer market seems to be generated by glamorous laser printers that captivate us with their speed, graphics capabilities, and PostScript brainpower. It's getting harder and harder to work up even a little enthusiasm for any humble dot matrix printer.

That's why IBM deserves double credit for introducing a machine as compelling as the new 24-pin Quickwriter.



PERSONAL INFORMATION MANAGERS

SYMANTEC CORP. GrandView

An electronic outline is a wonderful tool for organizing your thoughts; preparing articles, lectures, or presentations; and keeping lists. And Symantec's *GrandView* is the world's best outline. *GrandView* is also a strong candidate in the emerging field of PIMs, personal information managers.

GrandView allows you to load as many as ten outlines at one time as either full-screen



or multiple windows. Reorganizing the outlines is a breeze: move an outline entry with a keystroke combination, mark a number of entries and gather them to a single place, prioritize the subheads of a single entry, or name a range of entries and define a macro to move the current entry to the named range.

A vast array of customization tools allows you to redefine virtually any keystroke, to define keyboard macros, or to present various levels of the outline in different colors. And you can save a customized window or file setup for later recall.

The word processor includes a spelling checker and other word processing tools that make it easy to add text to a headline. But the program is particularly strong on presentation tools: it supports multiple fonts on HP LaserJet printers, including the most popular cartridges and downloadable fonts. It's a simple matter to place headers and footers, and to adjust the number scheme used to show outlines.

GrandView runs in text mode, but its drop-down menus, dialog boxes, and superb mouse support give it a distinct *Windows* feel. It is simply a wonderful tool for organizing and manipulating information. —Barry Simon

FACT FILE: *GrandView*, Version 1.0; Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; (408) 253-9600. List Price: \$295. Requires: 256K RAM, two double-sided, double-density floppy disk drives, DOS 2.0 or later. Not copy protected. Reviewed: December 13, 1988, page 113.

CIRCLE 690 ON READER SERVICE CARD

BACKUP SOFTWARE

FIFTH GENERATION SYSTEMS INC.

Fastback Plus

Without warning, your hard disk fails, an electrical storm blitzes your data, or you accidentally delete your entire set of budget worksheets.

One of the fastest, easiest,

level of sophistication you demand from a backup program.

Backup and restore can be launched from a command file automatically, if you want to bypass the menus entirely. As for speed, *Fastback Plus* is ready for the next backup diskette before you finish labeling the one you just removed.

Fastback Plus takes the guesswork out of the backup process by showing subdirectories and their contents on a split screen. Files can be selected for backup by name, date range, directory, or archive bit, or they can be marked individually. A particularly nice feature is *Fastback's* ability to estimate the number of diskettes and the



can also restore them to different directories and different devices. Fifth Generation Systems has kept pace with the market and has consistently improved the performance of its product without jeopardizing its installed base. *Fastback Plus*, Version 2.01, is a mature product that does a solid job of backing up data in record time.

—Priscilla Tate-Austin

FACT FILE: *Fastback Plus*, Version 2.01; Fifth Generation Systems Inc., 11200 Industriplex Blvd., Baton Rouge, LA 70809-4112; (800) 225-2775, (504) 291-7221 in La. List Price: \$189. Requires: 448K RAM, DOS 2.1 or later. Not copy protected. Reviewed: May 31, 1988, page 108 (Version 1.01).

CIRCLE 692 ON READER SERVICE CARD



WITHOUT WARNING, AN ELECTRICAL STORM SOMEHOW BLITZES YOUR DATA.

and least expensive ways to protect against data loss is to invest in Fifth Generation Systems' *Fastback Plus*. Version 2.01 wins the prize for speed, convenience, and a user interface that respects the

time required for a backup.

Often data needs to be restored to a different machine or to a new directory, especially in workgroup environments. *Fastback* not only creates DOS-readable files, but it

FILM RECORDERS

MATRIX INSTRUMENTS INC.

ProColor

Film recorders producing slides good enough for the corporate boardroom used to cost at least \$15,000 to \$50,000. Not anymore. Matrix Instruments' *ProColor* costs \$5,995 (\$7,990 with the controller board) and gives you slides of nearly the same quality as those from high-end film recorders costing two to five times as much.

The *ProColor* produces

Over The Years, We've Developed The Best Image In Monitors.



Ultra Vision 1000. A 19-inch analog multi-sync with VGA and up to 1600 x 1200 resolution.



MultiVision 770+. A 14-inch multi-sync with CGA, VGA and up to 800 x 600 resolution.



Crystal View 1901. A 19-inch system with Enhanced Graphics Filter, built-in CGA, and up to 1280 x 960 resolution.

We made the first amber monitor for the IBM PC.*

And the only 19-inch, multi-sync monitor to meet both IBM® and Apple® graphic standards.

Now, we're offering a family of high-resolution, monochrome and color IBM graphic standard monitors.

The 19-inch Ultra Vision 1000 offers extremely high resolution. Brilliant life-like colors. And the widest frequency range of any multi-sync monitor its size — so it works with virtually all graphic standards and resolutions.

The 19-inch Crystal View 1901 features our exclusive non-glare filter. It's a high-resolution, monochrome system that handles two 8½" x 11" pages of text or a B-size CAD drawing without scrolling or shrinking. Voted PC Magazine's "Editor's Choice."

The 14-inch, color MultiVision 770+. A multi-sync monitor with more image controls for maximum user comfort than any monitor its size.

Coming soon, the Super Vision VGA: the best VGA monitor you're likely to see.

PRODUCT	CAD/CAM/AE	Presentation Graphics	Desk Top Publishing	Word Processing	Spread Sheet
Ultra Vision 1000	✓	✓	✓	✓	✓
MultiVision 770+		✓	✓	✓	✓
Crystal View 1901			✓	✓	✓
SuperVision VGA				✓	✓

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See why, in IBM monitors, one brand is clearly superior.

TAXAN
A Revolution in Graphics

■ BEST OF 1988

outstanding slides in either 2K or 4K addressable resolution. Text is sharp and clear, with no appreciable jaggedness or fuzziness in the curving lines. It can handle 256 colors on a slide at once, out of a palette of over 16 million. The colors are evenly saturated and bright, and

lent documentation and the longest warranty period in the market: 1 year. And you get high-quality slide output for under \$8,000.

—Henry Fersko-Weiss

FACT FILE: ProColor; Matrix Instruments Inc., 1 Ramland Rd., Orangeburg, NY 10962; (914) 365-



there is almost no banding of colors in a sweep background.

What makes the ProColor so good is a combination of digital recording technology, a high-quality CRT—with a 7-inch-diagonal screen—and its fine electronic control of focus, beam position, and intensity. It comes standard with a Pentax 35mm camera but can also use a Polaroid 3 X 4 Instant Camera.

It's no surprise that Matrix has produced such a fine desktop film recorder—the company has been making high-end film recorders for 14 years. Because the ProColor uses the same add-in board and software as Matrix's QCR and PCR, it is instantly supported by more than 30 graphics programs with drivers for those models. The ProColor has excel-

0190 (ask for Computer Graphics Marketing). List Price: \$5,995, plus \$1,995 for the MVP-PC board or \$2,495 for the MVP-Star board. Requires: IBM XT, AT, or 100-percent-compatible with a hard disk, 512K RAM, DOS 2.1 or later. Reviewed: Not previously reviewed in PC Magazine. CIRCLE 678 ON READER SERVICE CARD

DESKTOP PUBLISHING

ALDUS CORP.

PageMaker

Aldus Corp.'s latest offering of *PageMaker* brings color, style sheets, text auto-flow, and text wrap to this *Microsoft Windows* desktop publishing application.

A powerful set of text style controls has been added, making it possible to create a page template, embed style

tags in a text file, and pour a complete document. The most powerful aspect of *PageMaker*'s style palette lets you tag a text file before importing it.

The style palette gives you complete control over text style definitions: font, size, leading, capitalization, style, alignment, tabbing, and color. The definitions may be stored and used as templates, or created as you build your document. Though overall performance is slowed with the added features, page design, layout, and printing are accelerated with auto-flow and text style tagging.

be wrapped around any object: a rule, box, photo, graphic, and so on.

Aldus has implemented a spot color function and support of popular color printers including the QMS ColorScript. Any element may be selected and colored although the number of displayable colors is limited by *Microsoft Windows*. *PageMaker* allows the user to edit both the name and hue of each color, making the addition of new colors simple, while an on-screen color palette speeds up the color selection process.

One of Version 3.0's most useful features is the addition



PAGEMAKER 3.0 OFFERS AN INCREDIBLY FLEXIBLE TEXT-WRAP FEATURE, ALLOWING ANY OBJECT TO HAVE TEXT WRAPPED AROUND IT.

A sophisticated feature of any electronic publishing system is irregular text wrapping. *PageMaker* 3.0 offers an incredibly flexible text-wrap feature, allowing text to

of import filters that allow you to read dBASE, Lotus 1-2-3, Symphony, and many other files directly. The beauty of the 1-2-3 import is that spreadsheet cells are automa-



Bitstream Type — The power to stop readers on the page.

Bitstream type has rapidly become the most popular way to give printed documents the crisp, professional appearance you get only with superior type.

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Bitstream type works with these and many other popular software packages.

CIRCLE 218 ON READER SERVICE CARD

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FONTWARE™

SCALEABLE TYPE

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ically assigned as tabbed columns in text. Previously spreadsheets were brought in as text with fixed spaces between cells.

Even with a \$795 price tag, *PageMaker*, Version 3.0, is a bargain compared with other DTP packages. *PageMaker's* strong suit is still flexibility in page composition, making it best at creating newsletters and brochures. But longer documents are now well supported with its new style palette.

—Gerard Kunkel

FACT FILE: *PageMaker*, Version 3.0; Aldus Corp., 411 First Ave. S., #200, Seattle, WA 98104; (206) 622-5500. List Price: \$795; upgrade, \$95; \$47.50 for Extended Technical Support Subscribers. Requires: 640K RAM, hard disk, DOS 3.1 or later, *Microsoft Windows 2.0* or 386 (comes as *Windows 2.0* runtime program), mouse or other pointing device compatible with *Windows*. Not copy protected. Reviewed: December 27, 1988, page 124.

CIRCLE 662 ON READER SERVICE CARD

PRINTER FONTS

IQ ENGINEERING
Super Cartridge I
1988 didn't start out as the best of years for owners of HP LaserJets and other pre-Series II laser printers. Sure, we

were still enjoying clockworklike performance and razor-sharp output from our first-generation lasers. But the news was full of soft fonts and fancy graphic tricks that our limited-memory machines will never see. Not willing to fork over the price of a Series II to get a PostScript brain transplant, we learned to be creative with our single-font cartridge.

Then the dam broke. That lonely socket became home for 55 fonts; virtually all the fonts that HP spread over 23 cartridges were suddenly available in the Super Cartridge I from IQ Engineering. Other vendors followed with lesser assortments, but nobody has a deal nearly as good: the Super Cartridge I retails for \$499 and is compatible with all HP lasers, as well as many compatibles.

IQ left behind only the most homely of HP's fonts and emulated other fonts' appearances by raiding public-domain libraries and cleaning up some of these fonts for better legibility. The results are always pleasing to the eye and convenient to use. A few clever maneuvers were required to squeeze so much into one cartridge: HP has set a 512K address space for fonts, so IQ Engineering had to use compression techniques to fit all 630K into one cartridge.

Super Cartridge I is the best thing to happen to LaserJet owners since they bought their printer.—Gus Venditto

FACT FILE: *Super Cartridge I*; IQ Engineering, P.O. Box 60955, Sunnyvale, CA 94088; (408) 733-1161. List Price: \$499. Requires: HP LaserJet (any model) or compatible printer. Reviewed: July 1988, page 38.

CIRCLE 672 ON READER SERVICE CARD

HARDWARE ACCESSORIES

CURTIS MANUFACTURING COMPANY INC.

Curtis Clip

We don't do comparison tests on \$6.95 pieces of plastic. Anyway, in the case of the Curtis Clip, it would be no

contest. After we'd seen 6 or more years of various manufacturers trying to position paper next to our monitors, Curtis finally got it right. We've seen pantograph arms, things with more moving parts than a grandfather clock, pedestals, and easels with gooey spots that collect everything but your papers. It comes to this: the Curtis Clip



WE'VE SEEN EASELS WITH GOOEY SPOTS THAT COLLECT EVERYTHING BUT YOUR PAPERS.



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A lot of accounting software companies will try to tell you their product does more than just accounting. So even though you can get Peachtree Complete™ II—the most complete accounting software—for a lightweight \$199, we won't tell you that it's more than an accounting package. Just that it's the most accounting power you can get for your software dollar.

Now we've bundled Peachtree Complete II and Peachtree Data Query™ II together, and cut the price \$100. So you're not only getting full-featured accounting, you're also getting custom reporting and analysis. Peachtree's "Double Bonus Bundle" gives you two first-rate software packages for one low price—Peachtree Complete II, The Business Accounting System and Peachtree Data Query II, the Custom Reporting Tool for Peachtree Complete II, both for only \$298. And that's the best deal around.

Still Just \$199 Complete. We will continue to tell you that Peachtree Complete II offers the most powerful accounting software you can buy at virtually any price. Designed and sold as a \$5,000 accounting system, the latest version of Complete II represents a vastly expanded and improved product, yet sells for an incredibly reduced price of just \$199. With that kind of value, and more than 250,000 satisfied users, our record speaks for itself.

Peachtree Complete II is a comprehensive accounting system developed

to meet the needs of small- to medium-size businesses. It comes with eight high-power modules that may be used individually, or fully integrated for absolute maximum accounting efficiency:

- General Ledger
- Accounts Receivable
- Accounts Payable
- Invoicing
- Inventory
- Payroll
- Fixed Assets
- Job Cost

And Peachtree Complete II is designed using the latest software innovations, like full-color scrolling reference tables, pop-up windows, and short-cut keyed menus. We've increased memory capacities as high as \$999,999.99 in key areas, added Service Invoicing, included Range Printing, and expanded to allow an unlimited number of companies.

Error handling is quick and easy, with plain English messages and suggestions. Context-sensitive Smart HELP is on-line, all the time. And as always, Peachtree Complete II comes with the most thorough documentation—a separate quick-start Installation Guide, Accounting Primer, seven-volume Reference Library, and extensive on-line tutorials on each module—all at no extra charge.

Save Even More on Peachtree Data Query II. So while you're getting



Compare Feature for Feature

General Ledger

- Chart of Accounts includes 76 suggested and 26,000 user-defined accounts
- Financial statement comparisons may include current period and year-to-date with budget and/or prior period comparison

Accounts Receivable/Invoicing

- Maintains open item or balance forward customers
- 12 to 14,400 customers

Accounts Payable

- Partial payment of invoices
- 12 to 14,400 vendors
- Checks processed with unlimited invoice listing on audit

Inventory

- Supports average, last purchased and standard costing methods
- Up to 32,500 inventory items (SKU's)

Fixed Assets

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Job Cost

- Tracks costs and profitability on a job-by-job basis

Payroll

- Built-in current year federal, state, city and county tax tables for all 50 states with automatic calendar file capabilities

- Automatic general processing supporting hourly salaried, commission or draw against commission job types

- Printed and magnetic media 9-25 generated automatically

- Processes up to 1,500 employees

And Many More!

the best deal on the best accounting software, why not get an even better bargain? Extend the power of your Peachtree accounting to include the most advanced custom reporting and analysis with PDQ II, and when you buy both, save \$100!

PDQ II lets you turn raw figures into highly sophisticated reports, allowing you full access to the important accounting data in your Peachtree Complete II files. From the simplest mailing labels to the most detailed budget analyses, Peachtree Data Query II opens up the potential of your computerized accounting, with no risk to your files, and no re-keying of accounting data.

And now, PDQ is easier than ever to use, with all new user instructions and on-line practice sessions that lead you through the system and build confidence as you go.

Choose from PDQ's own pre-designed reports, design your own (and

store the formats for future use), even export data to popular applications like dBASE III® and Lotus 1-2-3®. PDQ's simple, clear approach to report writing allows maximum control and flexibility. You can begin creating reports with PDQ in just minutes. And as you continue using it, PDQ can perform highly complex, intricate analyses.

Save a Bundle When You Buy Both. We think using PDQ to make Peachtree Complete II more than an accounting system makes good business sense. So we bundled them together and made it well worth your while. For a limited time, Peachtree's "Double Bonus Bundle" is available for just \$298. That's two regularly-priced \$199 packages for one low price, and that's a savings of \$100.

The "Double Bonus Bundle" is a limited-time offer, so call today! And of course, if all you need is the best accounting package your money can buy, Peachtree Complete II by itself is still only \$199.

Money Back Guarantee. As with all our products, we stand behind Peachtree Complete II and PDQ II with a toll-free hotline for technical support (\$1 per minute, \$20 minimum on your credit card). And both are covered with a 30-day money-back guarantee when you buy directly from Peachtree. If for any reason you're not satisfied, you can return the product within 30 days for a prompt refund. That's the Peachtree Software promise. (A \$25 restocking fee applies to all returns.)

Hardware Specifications: Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory (512K required with DOS 3.3) and a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3 1/2" media optionally available. Not copy protected.

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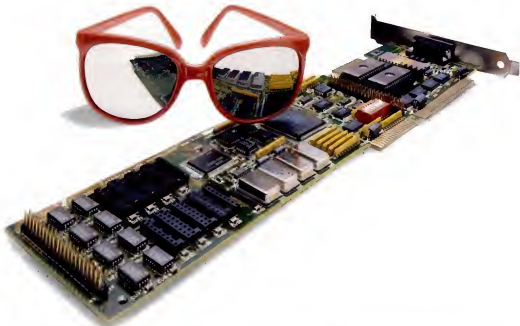
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CIRCLE 127 ON READER SERVICE CARD

The following are registered and unregistered trademarks of the companies listed: FastWrite VGA, Video Seven Inc., PS/2, Display Adapter, International Business Machines Corporation. Variable frequency monitor required for greater than 640 x 480 resolution. Monitor capable of 48 KHz needed for 1024 x 768. Video Seven reserves the right to change specifications without notice.

works. It hangs off either side of your monitor, takes up no desk space, and even folds back out of the way. What are you waiting for? Go out and get one on your lunch hour. Before the price goes up.
—Bill Machrone

FACT FILE: Curtis Clip; Curtis Manufacturing Company Inc., 30 Fitzgerald Rd., Jaffrey, NH 03452; (603) 532-4123 ext. 87 for local dealer. **List Price:** \$6.95. **Reviewed:** Not previously reviewed in *PC Magazine*.
CIRCLE 884 ON READER SERVICE CARD

DATABASES

DATAEASE INTERNATIONAL INC. DataEase

DataEase is a database manager that allows you to set up relationships between different data tables simply by answering questions and filling in blanks on the screen. You can create sophisticated applications with custom menus and complex, formatted reports, and never write a single line of programming code.

You create data entry screens by painting fields on the screen and then answering a series of questions about the field characteristics. Although it has an extremely powerful and flexible query language, *DataEase* will

prompt you through every step.

DataEase also automates procedures that other programs would require a page of programming to accomplish. You can define a field as sequential, and *DataEase* will increment it for each new record. You can quickly create a prompt screen that asks for information required to select records needed for a stored report. And this is accomplished through the consistent use of function-key commands, an interface most users will find extremely easy to handle.

DataEase puts more power in a user's hands with less effort than practically any other product on the market, but that's not the only reason it deserves its Best of 1988 status. *DataEase* has grown into a full-blown family of products covering a wide range of applications.

There is no database program as easy to set up and as powerful as *DataEase LAN*, and it is a snap to convert single-user applications to the multiuser version. *DataEase Connect* does the same for mainframe databases, making it easy for the PC user to use data seamlessly in a wide range of mainframe formats while maintaining security and integrity.

DataEase Developer automates custom application development and documentation, and *DataEase Exec* is an affordable runtime version.

The *DataEase* family is an excellent demonstration that power and ease of use don't have to be mutually exclusive. —Alfred Poor

FACT FILE: *DataEase*; DataEase International Inc., 7 Cambridge Dr., Trumbull, CT 06611; (800) 243-

5123, (203) 374-8000 in Conn. **List Price:** *DataEase*, Version 4.0 (single user or first user on LAN), \$700; *DataEase Workstation Pack*, Version 4.0 (adds three users on LAN), \$750; *DataEase Developer*, Version 1.0, \$1,995; *DataEase Exec*, Version 1.1, \$750; *DataEase Connect*, Version 1.0, \$995. **Requires:** 640K RAM, DOS 3.1 or later. Not copy protected. **Reviewed:** November 15, 1988, page 249.

CIRCLE 883 ON READER SERVICE CARD

COMMUNICATIONS

INTEL CORP. Connection CoProcessor

Your word processor can send a file to a printer but

When you're in a word processor or spreadsheet, wouldn't it be handy to send a document to a LAN or fax just as easily as to the printer on your desk? DCA and Intel have written a communications standard that should let you do just that. It's called DICAS (DCA/Intel Communications Application Specification), and both your software and hardware must conform to it. Last September, Intel started shipping the first DICAS-compatible hardware product, the Connection CoProcessor.

The Connection CoProcessor is an XT/AT-compatible add-in board with a



THE CONNECTION COPROCESSOR IS THE FIRST STEP TOWARD SEAMLESS COMMUNICATIONS FROM WITHIN YOUR FAVORITE APPLICATION PACKAGES.

probably not to a fax machine, LAN, or e-mail system. To do that, you have to run special programs that talk to the outside world—usually a different one for each kind of transmission.

9,600-bit-per-second fax modem and an option slot for a communications daughtercard. For now, a 2,400-bps Hayes-compatible modem is the only available daughtercard, but expect network



XyWrite III Plus makes powerful word processing a piece of cake.

New A La Carte menus let you use the power of XyWrite III Plus right from the start. A single keystroke produces a menu of logical options. Simple choices achieve sophisticated results.

A La Carte menus are an alternative to XyWrite's command system. They let you go to work immediately while reinforcing the commands and reducing the learning curve. They also provide help for the task at hand.

Unlike other menu systems, you can choose to work with A La Carte or without it. After all, when you know exactly what you want, you don't need to consult a menu.

XYQUEST

For product & dealer information contact:
XYQUEST, Inc.
44 Manning Road, Billerica, MA 01821
(508) 671-0888



#1 RATED ADVANCED
WORD PROCESSOR, 1988

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cards soon. The CoProcessor also has an 810 mini/DIN jack that will connect to an Apple LocalTalk network, or an input port for a digitizer, light pen, or mouse.

The CoProcessor works in the background and uses a 10-MHz 80188 chip to take the communications load off your CPU. If you communicate directly with another Connection CoProcessor-equipped PC over phone lines, the board's fax modem transfers files at a snappy 9,600 bps—with no impact on your foreground tasks. The Intel software that drives this is easy to install and use.

So far only one application program—Q&A from Symantec—drives the Connection CoProcessor directly. While waiting for more applications to support DICAS, you can run the Connection CoProcessor's own software to do conventional communications jobs very nicely. And the wait may not be long. Major software houses, including Borland, Microsoft, Lotus and Ashton-Tate, have promised to write programs conforming to the DICAS standard.

Intel's Connection CoProcessor is the first step—

and a convincing one—toward seamless communications from within your favorite application packages.—Jared Taylor

FACT FILE: Connection CoProcessor; Intel Corp., Mail Stop C03-07, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124; (503) 629-7354. **List Price:** \$995. **Requires:** Full-length slot. **Reviewed:** October 31, 1988, page 52.

CIRCLE 696 ON READER SERVICE CARD

INTEGRATED SOFTWARE

SOFTWARE PUBLISHING CORP.

PFS:First Choice

Elegant, simple, powerful. These are lofty words to use when describing a software program, but they are the best words to use when it comes to PFS:First Choice.

PFS:First Choice is an integrated package with word processing, database, spreadsheet, graphics, and communications, and yet it is only one of Software Publishing's treasures. Chances are, you probably already use something from the company's arsenal of easy-to-use programs, whether it is

PFS:Professional Write or the stellar Harvard Graphics.

PFS:First Choice's interface makes the package a pleasure to use. It comes with beautiful pull-down menus and has a universal clipboard that lets you copy from one application to another. The word processor has a dictionary and thesaurus, and the spreadsheet can read and write Lotus 1-2-3 files. The graphics are a subset of Harvard Graphics, and the database is plenty powerful.

Partially in response to Microsoft Works, Software Publishing has added some powerful enhancements to PFS:First Choice in Version 3. Just to mention a few, PFS:First Choice now has support for Lotus 1-2-3 .WK1 files and multiple rulers in documents, and it can create table views in the database. It can record keystrokes to create macros, and you can even configure PFS:First Choice as a DOS shell to call other programs from the main menu.

You've got to hand it to the folks at Software Publishing. They've got it down: an interface that is simply stunning, enough features to satisfy most users, and a clear, straightforward presentation. Microsoft Works, look

out—PFS:First Choice is just plain better.

—Christopher Barr

FACT FILE: PFS:First Choice, Version 3.0; Software Publishing Corp., P.O. Box 7210, 1901 Landings Dr., Mountain View, CA 94039-7210; (415) 962-8910. **List Price:** \$159. **Requires:** 512K RAM, DOS 2.0 or later, two floppy disk drives or one floppy disk drive and one hard disk drive. Not copy protected. **Reviewed:** March 15, 1988, page 222 (Version 2.0).

CIRCLE 679 ON READER SERVICE CARD

THE BEST OF 1988 CONTRIBUTORS

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PC BRAND 286/12 \$995



12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 • Landmark™ Speed 16MHz
512K, 1.2MB or 1.44MB Drive, 101- Keyboard

Standard System Features:

- 80286 Processor Operating at 12MHz with Zero Wait States delivering 16MHz Effective Throughput
- 512K RAM expandable to 4MB on the System board using 256K and/or 1MB 100ns RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive Controller
- Enhanced 101-key AT Style Keyboard
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- Built-in System Board LIM EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Small foot print case with 5 Disk Drive bays

Options:

- Full size 5 drive case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Tower Case

Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card				
Video Drivers	384B	40MB-40MB	40MB-20MB	40MB-20MB
Mono	\$1381	\$1485	\$1594	\$1725
EGA	\$1775	\$1879	\$1988	\$2119
VGA	\$1946	\$2050	\$2159	\$2290

PC BRAND 286/20 \$1400



Ideal Novell Server!

20 MHz Clock, Zero Wait Operation
Norton SI 20.4 • Landmark™ Speed 25.9MHz
512K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- 80286 Processor Operating at 20MHz with Zero Wait States in interleave mode delivering 26MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB 100ns RAM chips (4MB on motherboard and 4MB on optional special interleaving daughter card)
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
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- Built-in System Board LIM 4.0 EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- 386SX Upgrade • Tower Case • 4MB Interleaving Ram Card
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Factory Installed RAM Upgrades

Standard Pre-Built Configurations:

286/20 With 512K, Hard Disk Drive, Monitor & Video Card							
Video Drivers	40MB-40MB	40MB-20MB	40MB-20MB	110MB-20MB 1:1 RLL	150-10MB 1:1 ESDI	150-10MB 1:1 ESDI	150-10MB 1:1 ESDI
Mono	\$1890	\$1999	\$2130	\$2396	\$3100	\$4023	
EGA	\$2284	\$2393	\$2524	\$2790	\$3550	\$4417	
VGA	\$2455	\$2564	\$2695	\$2961	\$3800	\$4588	

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Standard System Features:

- 10MHz Nec V20 CPU with 1.5 times the power of the 8088!
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- 12" Monochrome Monitor
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- Set-up & Operating instructions.

Standard Pre-Built Configurations:

PCV20 AD-II With 512K, Hard Disk Drive, Monitor & Video Card					
Video	1 Floppy	2 Floppy	20MB	30MB	40MB
Mono	\$695	\$770	\$964	\$990	\$1107
RGB	\$879	\$954	\$1148	\$1174	\$1291
EGA	\$1089	\$1164	\$1358	\$1384	\$1501

PC BRAND 386/20 \$2100



20 MHz Clock, Zero Wait Operation
Norton SI 24 • Landmark Speed 30MHz
1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- Intel 80386 Processor Operating at 20MHz with Zero Wait States in interleave mode delivering 30MHz Effective Throughput
- 1024K RAM standard expandable to 16MB via 32Bit RAM boards using 256K and/or 1MB 100ns RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 or 80387 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, SCOM and PCNET compatibility
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 32Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- 32/64KB Cache Processor • Weitek Coprocessor • Tower Case
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • 8MB 32Bit RAM Card Upgrade

Standard Pre-Built Configuration:

386/20 With 1024K, Hard Disk Drive, Monitor & Video Card						
Video	Drives	40MB-40MB	40MB-20MB	80MB-20MB 1 386L	150-30MB 1 16SDI	320-30MB 1 16SDI
Mono	\$2590	\$2699	\$2830	\$3096	\$3800	\$4723
EGA	\$2984	\$3093	\$3224	\$3490	\$4300	\$5117
VGA	\$3155	\$3264	\$3395	\$3661	\$4450	\$5288

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PC BRAND 386/25 \$2450



"Faster Than A Speeding Bullet!"

Computer Shopper Cover Story
November, 1988

25 MHz Clock, Zero Wait Operation
Norton SI 28.3 • Landmark Speed 35MHz
1024K, 1.2MB or 1.44MB Drive, 101-Key-board

Standard System Features:

- Intel 80386 Processor Operating at 25MHz with Zero Wait States in Interleave mode delivering 35MHz Effective Throughput
- 1024K RAM standard expandable to 16MB via 32Bit RAM boards using 256K and/or 1MB RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 or 80387 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit & 2 32Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- 32/64KB Cache Processor • Weitek Coprocessor • Tower Case
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • 8MB 32Bit RAM Card

Standard Pre-Built Configurations:

386/25 With Hard Disk Drive, Monitor & Video Card						
Drive/Video	40MB-40MB	40MB-20MB	80MB-20MB	110MB-20MB 1 3.5"	150-10MB 1 3.5"	220-10MB 1 3.5"
Mono	\$2940	\$3049	\$3180	\$3446	\$4200	\$5073
EGA	\$3334	\$3443	\$3574	\$3840	\$4600	\$5467
VGA	\$3505	\$3614	\$3745	\$4011	\$4800	\$5638

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Combo Controller,
Backlit Display

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3200; 1MB, 80286, EGA, 40MB HDD, FDD	3650
5100; 2MB, 80386, EGA, 40MB, FDD	4795
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MULTISPEED EL-2	1495
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MITSUBISHI	
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All Magnavox monitors feature 2 Yr. Warranties!	
12" Amber TTL Monochrome	\$79
14" VGA Paper White Flat Screen	Call
13" RGB (640x200) Color	230
13" EGA (640x400) Color	415
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PRINCETON GRAPHICS	
Max 12 TTL Monochrome	\$138
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Ultrasync 12" Multifreq. EGA/VGA	520
LM 300/301 Full Page Desktop Pub.	550
AMDEK	
410 Series 12" Mono Wht./Amb./Grn. \$149	
1280 Desktop Pub. Mono Display	679
MITSUBISHI	
1381 Diamond Scan	\$499
3905 19" CAD Monitor	1965
SONY	
Multiscan 1303 13" (800 x 600)	525
Multiscan 1302 13" (1024 x 768)	645
ZENITH	
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NEC 14"Multisync II

800x600 Resolution EGA/VGA Monitor



\$589

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PC BRAND 100% Hayes Compatible!	
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2400 Baud Internal w/Bitcom	95
2400 Baud External	129
HAYES	
1200 External	\$270
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TELEBIT	
Trailblazer+ 19,200KB	Call
US ROBOTICS	
Courier HST/9600	599
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1.44MB 3.5" HH Grey w/5.25" Mounting 95	
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40MB 28MS ST251-1	459
80MB 28MS ST4096 Full Height	590

MINISCRIBE

40MB 61/40MS M3650	\$319
40MB 25MS M3053	455
63MB 61/40MS M3675 RLL	360
71MB 22MS M3085	659
71MB 28MS M6085 Full Height	585
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150MB 16MS M3180E Full Height	1440
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45MB 28MS ID45H Half Height	\$489
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2.2GB Maynard 220H5 8mm Drive	4350

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Dest 1020/2020 Scanners	Call
Diamond Flower HS3000 Hand Scan	\$249
300/400DPI 6 Grey Levels HALO DPE	
Desktop Publisher GEM/HALO/	
PC-Paint/Windows File Format Output.	
Hewlett Packard Scanjet	989
Microtek MSF300G	2895
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Microtek MSF300Q w/64 Grey Levels 1920	
Princeton L5300 Scanner & Adapter	750
Summasketch 12x12	378
Summasketch 12x18	335

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P2200 170/55	345
P960XL 400/140 1030	
PS200 265/90	530
P5300 Wide	650
LC890 Postscript Laser Printer	3250
PANASONIC	
10801 144/28	170
10911 192/38	185
1124 192/63	339
1592 220/38	390
1595 290/51	449
1524 240/80	545
P4450 Laser 11PPM HP Compatible	1595
OKIDATA	
ML390 270/90	465
ML391 270/90	645
ML320 300/62	339
ML393 450/120	Call
HEWLETT PACKARD	
Deskjet	690
Laserjet II	1720
STAR MICRONICS	
NX1000 140CPS	179
NX15 120/30	315
TOSHIBA	
3215L 216/72	Call
3415L Wide Carr Call	
3515X 360/120 Wide Carriage	Call
CITIZEN	
120D 120/25	149
180D 180/29	170
MSP40 240/40	320
MSP45 Wide	Cal
MSP50 250/50	385
T224 200/132	605
Tribute 124 200/132	439
DICONIX	
150P 150/50	305
300WP 310/73	Call

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CALCOMP	
1023	\$3800
1042	7499
1043	6499
1044	10200
HOUSTON INSTRUMENTS	
DMP41, DMP42, DMP52	Call
DMP52MP, DMP61, DMP62	Call
ROLAND	
DXY885, DXY990, DPX2000	Call
DPX3300, GRX300, GRX400	Call

NEC P2200 Printer



24Pin 170CPS Draft 55CPS Letter quality

\$340

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NOVELL	
4 User ELS 286 Level 1	399
8 User ELS Advanced Netware 286 V2.12	879
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NP600 Ethernet File Server Board	685
NE1000 Ethernet Card	45
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Disksless Workstation	640
G-NET	Call
RXNET	Call

WESTERN DIGITAL	
Ethercard+A for PS/2	320
Starcard+	233
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ARCNET Passive Hub	72
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286/386 Fully-Configured Server	Call

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INTEL Inboard 386 AT	1039
Digiboard Smart 8 Port Serial Card	Call

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3MB Multifunction+Memory for AT's110	
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FO500	1550

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M1200	799
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TSH3300	1395
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4800 Baud Fax Card w/Software	249
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PC BRAND	
5.25" 100 Diskette Locking Storage Box 8.95	
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SONY	
360Kb DSDO Diskettes Box of 10	112
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High Resolution (250DPI) Microsoft Compatible
With Free PC Paintbrush



\$40

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CIRCLE 311 ON READER SERVICE CARD

Abort, Retry, Fail?

The bulk of this issue is dedicated to the people and products that made 1988 a great year. This article is respectfully dedicated to everything that made it memorable.

Media Stars

Today in History

"Marketing is now the main factor in the success of a micro. Its technical qualities need only be adequate . . . Compaq and Osborne have the best prospects in the IBM clone market because of strong marketing."

—Data Processing Digest,
August 1983

Soft Wear Versus Hard Wear

© 2000 Blackwell Science Ltd

[illegible]

Media Stars

VisiCalc inventor Dan Bricklin appeared in an ad for Dexter dress walking shoes. Peter Norton appeared in a Dewar's Profile: "Profile: Quiet, committed and independent. 'Not really, I'm just your classic computer nerd who got lucky.'"

DEWAR'S PROFILE

PETER NORTON
 President,
 NORTON-ROSEN
 & COMPANY, Inc.,
 CEO, Future Norton Computer
 & Software Marketing Center
 for the past 10 years. "When I
 look at the past, you always
 see a lot of things that were
 done in the past, and I
 think that's a good thing."
 He is a member of the
 National Academy of
 Sciences and the
 National Academy of
 Engineering.



242

NAMESAKES

Borland's Quattro and Mary Kay Cosmetics' Quattro cologne—not to mention Audi's Quattro.

PRICE HOLOCAUST

NEW ITEMS

Turbo C.....\$29
TAKAN 770+.....\$529
Multivac Smartvac 1200004.....\$79
modem.....\$17
Ivyrock.....\$17
AS Switchbox.....\$39

PRINTER CLEARANCE

FX-80/85 sheet feeder.....\$69
LV-800.....\$79
FX-65.....\$79
IQ-450.....\$499
IQ-850.....\$699
IQ-2500.....\$949

Sal

List

KX-P
• 9 pin E
• 240/45
• 7k pin
• friction
• Enhance

If anyone complains, just tell 'em they don't have a sense of humor: Houston-based Computer Post stores featured a "Price Holocaust" ad campaign for Panasonic printers. Two weeks later the same ad ran as a "Price Armageddon."

Rip Van Winkle Department (PC Division)

Letter to the editor of *PC Magazine*:

"Gentlemen, I have just wasted \$2.95 on your Feb. 29, 1988, issue. The cover promised 'PC Labs Tests 55 Word Processors.'

"However, there was not a single word about word processors, but instead reviews of word processing software programs for those already possessing computers. This is misrepresentation! I want to buy a word processor."



Rube Goldberg lives: Laptop-Leg, a telescoping aluminum monopod (\$24.95 from Input Systems, Miami; (305) 252-1550), takes the weight of your laptop off your knees.



Imagine what he'd make in a good year: Lotus chairman Jim Manzi made the cover of *Business Week* as America's highest-paid executive for the previous year. Lotus then proceeded to lose half its 17 vice presidents and was more than half a year late with Release 3 of Lotus 1-2-3.

Great Software That Shipped in 1988

1. _____
2. _____
3. _____
4. _____
5. _____

Wait! We Meant the Model 50Z

In a report on the home office (July 1988), *Money* magazine explained IBM PCs with this photo caption:

"The IBM PS/2 Model 50 computer (\$3,595) is among the successors to the old PC line. Fast and capable, it should grow in value as more software is written for it."

USERS SATISFIED WITH 3 1/2 INCHES
One significant occurrence that I did not see mentioned in your 1987 post-mortem was the acceptance of 3 1/2-inch floppies by the MS-DOS masses. Sure, the IBM PC Convertible was introduced in 1986 and the HP Portable even before that, but the

Maybe their readers are: Headline in InfoWorld's letters page, Feb. 15, 1988.

Great OS/2 Software
That Shipped in 1988

1. _____
2. _____
3. _____
4. _____
5. _____



Killer Bee Alert

Martin Marietta Energy Systems glued microchip devices to the backs of killer bees to track their northward migration.

Is It Official if the Document Is Signed in a Heart-shaped Bathtub Using a Swizzle Stick Dipped in Bloody Mary Mix?

During a meeting of the Copyright Society held in the Pocono Mountains, the Library of Congress's Copyright Office announced that software copyrights protect screen displays from infringement (a big win for major software companies). At the same time, it said that menu screens are uncopyrightable (a glimmer of hope for pro-

ducers of lookalike software). Five days later, when the ruling was officially published in the *Federal Register*, the reference to uncopyrightable menus disappeared. While the wording of the *Federal Register* is usually final, the ruling with the original wording had already been signed; a federal court may have to decide which version prevails.



Hyundai XT Turbo (the PC) and Subaru XT Turbo (the car).

So That's Why the PC Continually Ordered Out for Pizza

An Anaheim, California, computer repair technician traced the cause of a malfunctioning PC to a joint of marijuana that had been wedged inside a floppy disk drive.

Then the Cockroach Crawled Inside the Disk Drive, Put On a Led Zeppelin Tape, and Ordered Out for Pizza

Letter to the editor of *PC Magazine*:

"I am interested in the possible deleterious effects that populations of cockroaches may inflict on personal computers and electronic equipment over extended periods of time. Could you please send me any information that you have on this subject at your earliest possible convenience?"



Hidden meaning? What hidden meaning? Ad for Symantec's Q&A Write word processor.

Lotus Executives
Who Didn't Sell
Their Stock Just
Before Lotus
Announced That
1-2-3 Release 3
Would Be Half a
Year Late

- 1.
- 2.
- 3.
- 4.

A STORY ABOUT A SOFTWARE COMPANY THAT SHIPS BUG-FREE PROGRAMS ON TIME, WITH TOLL-FREE SUPPORT AND FREE UPGRADES? NAAAH - NOBODY'D BELIEVE IT.

■ ABORT, RETRY, FAIL



Microsoft

As a result of the makeover, you now control the mouse with your fingertips instead of the palm of your hand. Besides a more responsive, natural feel, this frees your palm to do something else.

Ad for the Microsoft Mouse.

Most Useful Press Release of 1988 (Gold Medalist)

"All types of written and printed communications—business, personal, scientific and artistic—can be enhanced by the use of cotton paper fibers, is the message of a new video just released by the Cotton Fiber Paper Manufacturers of the American Paper Institute . . ."

Most Useful Press Release of 1988 (Silver Medalist)

"Hayes Microcomputer Products Inc. today confirms the amicable settlement of the

divorce action concerning its founder, Dennis C. Hayes. This settlement . . . concludes any legal actions involving the company and will have no adverse effect on continued operations."

Most Useful Press Release of 1988 (Bronze Medalist)

"I am pleased to enclose information on the Dutch PTT Approval that was recently granted to Emucom Inc. The information enclosed includes a press release announcing that all of Emucom's X.25 PAD products are fully certified for use on the Dutch Data Network (DNI). If you have any questions . . . please do not hesitate to call."

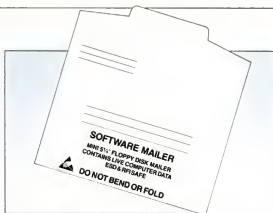
DOS-to-Travel, Cadillac-Style

Dillinger/Gaines Coachbuilders now offers an \$80,000 [Donald] Trump Series Golden Edition Cadillac limousine, complete with two cellular phones, a cellular fax machine, a paper shredder, and pop-up rosewood writing tables. Portable computers are optional.

NAMESAKES

Opus One, hyperdrawing from Raykore Software, and Opus One, the wine.





Let's hope it's not a virus: Floppy disk mailer.

It Felt Good When He Stopped

Las Vegas casinos ejected a man for card counting. The blackjack player strapped a tiny computer to his leg and entered data by tapping his shoes, which contained microswitches. The computer responded with electrical impulses in a wire attached to the strap of the cardplayer's athletic supporter.

Great Software That Shipped on Time in 1988

1. _____
2. _____
3. _____
4. _____
5. _____

Where Are They Now: From PCs to Liquid Assets

Lore Harp, former head of Vector Graphic Inc., now runs Aplex Corp. Aplex markets Harp's invention: Le Funnele, disposable paper funnels that let women use public restrooms standing up.

In a Manner of Speaking

When *USA Today* profiled Harp, it described her as a person who likes to "hurl herself against the current."



Next Year, She Branches Out with Abby's Computer Insider Newsletter

Dear Abby responded to HAL, a reader who complained that "one of the most destructive forces in the workplace today is addictive computer hobbying. . . . When you give a 4-year-old a hammer, suddenly a lot of things need hammering. When you give a burned-out worker or administrator a

computer, a lot of things need computerization."

"Dear HAL: There is no denying that computers have become the 'in' toys for those who can afford (and understand) them. In fact, they are so 'hot' that next year a more sophisticated model will come out and make the latest obsolete."

Computer compulsion

DEAR ABBY: A woman wrote to with a serious concern about her boss's computer addiction, and you pointed out how useful computers are and brushed aside her complaint. One of the most destructive forces in the workplace today is addictive computer hobbying. Computers are essential tools in the workplace, for much time and money are wasted when "working" with the computer becomes an end in itself. The reason that computer hobbying is as dangerous to that it is difficult to distinguish from



DEAR ABBY

real work. The loss of the woman who wrote to you has discovered that "working" on the computer is more fun than any other part of his job (or hers). He will not always recognize the operation and back off. He will con-

sume to spend all his time on computers.

When you give a 4-year-old a hammer, suddenly a lot of things need hammering. When you give a burned-out worker or administrator a computer, a lot of things need computerization.

DEAR HAL: There is no denying that computers have become the "in" toys for those who can afford (and understand) them. In fact, they are so "hot" that next year a more sophisticated model will come out and make the latest obsolete. Readers?

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20 MEG Harddrive

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- Floppy Disk Controller Included
- Fits IBM PC, XT & Compatibles
- List Price \$499

\$249⁹⁵

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- 38 ms Access
- 40 Mega Byte Storage
- Half Height Construction
- List \$699

\$339⁹⁵

Seagate 80 MEG Harddrive

- 28 ms Average access time
- 80.2 Megabytes per drive
- 5 Discs
- List \$799

\$599⁹⁵

KLÖK

3 1/2" 20 MEG Harddrive

- 28 Major Components
- Full ST-412 Interface Compatibility
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Multi-Head Wide Carriage Printer
With High Dot Resolution



- 720 CPS - 150 CPS NLQ
- 8K Print Buffer
- Print Speed of 214 LPM in Draft
- 6 Print Heads Achieve High Dot Resolution in Higher Speed
- NLQ Speed Of 47.4 LPM
- 136 Column Wide Carriage
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- Parallel Centronics Port

Our Low Sale Price

\$699⁹⁵

List \$1995

12" TTL Monochrome Monitor



For IBM & Compatibles

- High Resolution
- 80 Column
- Non-glare Screen
- 1000 Lines at Center
- Super Low Sale Price

Our Low Sale Price

\$49⁹⁵

List \$199

IMTEC 14" Multiscan Monitor

IBM CGA, EGA, VGA, and PGA
Compatibles



- Tilt and Swivel Base
- 14" non-glare screen
- 256 PGA colors
- 720 Dots Horizontal
- 480 Dots Vertical
- One-year Warranty
- IBM PC XT and AT compatibility

Our Low Sale Price

\$399⁹⁵

List \$599

PC, XT & AT Compatible Internal Disk Drives

TEAC 360K - 5 1/4" Drive

- Double Sided/Double Density
- Fits IBM PC, XT & Compatibles
- Half Height

\$79⁹⁵

List Price \$199

TEAC 1.2 M - 5 1/4" Drive

- 1.2 Mega Byte Memory
- Fits IBM AT & Compatibles
- Double Sided/Double Density

\$99⁹⁵

List Price \$199

TEAC 720K - 3 1/2" Drive

- Double Sided/Double Density
- Fits IBM PC, XT & Compatibles
- Half Height

\$99⁹⁵

List Price \$199

TEAC 1.44 M - 3 1/2" Drive

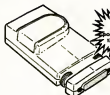
- 1.44 Mega Byte Memory
- Fits IBM AT & Compatibles
- Double Sided/Double Density

\$139⁹⁵

List Price \$299

1200 Baud Migent Pocket Modem

Free Terminal Software



Thousands of the most popular software titles in stock!

- Hayes compatible
- Runs on AC or battery
- Turns on/off automatically
- Small enough to put in your pocket
- Plugs directly into your serial port on many computers
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Our Low Sale Price

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List \$413



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ALL ARE Hayes COMPATIBLE
ALL SOFTWARE INCLUDED

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- Automatic Dialing & Answering
- Built-In Speaker with Volume Control
- Separate Voice and Data Jacks
- Both Touch Tone and Pulse Dialing
- Extensive Diagnostics

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2400 Baud Internal Modem

- Full or Half-Duplex Operations
- Auto Dial In Pulse, Tone & Tandem
- FCC Certified and Registered
- Auto Originate and Answer Modes
- Reverse Mode Dial

Our Low Sale Price **\$99⁹⁵** List \$149

2400 Baud External Modem

- 7 System Indicator Lights
- Both Tone & Pulse Dialing
- Built-In Speaker with Volume Control
- For all Computers

Our Low Sale Price **\$114⁹⁵** List \$249

"1 MEGA BYTE"

20 MHz 0 WAIT 386 AT COMPUTER



- 1 MEG RAM on Board
- I/O Board - Parallel - Serial - Game Ports
- Award BIOS
- Dual Floppy/Hard Controller
- 101 Keyboard Keytronics
- Clock/Calendar
- 25 MHz Throughput
- Case with Keylock and five integral peripheral slots
- 200 Watt power supply
- 1.2 MEG Floppy Drive

Low Sale Price **\$1999⁹⁵** List \$2995

Intec Multisync Monitor shown \$399.95

5 1/4" Floppy Disks

100% Certified • Lifetime Guarantee

19¢ each

Double Sided
Double Density

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REPLACING PC-BASED

If being covered on the front page of *The New York Times* and *The Wall Street Journal* is a sign that you've arrived, then voice mail is a technology whose time has come. It's been hailed as the next big revolution in office communications, and praised as the way to "make people reachable in today's mobile society." Even the Bell Operating Companies are preparing to offer voice mail services.

The concept underlying voice mail is easy enough to understand—a marriage between digital recording on a computer and telephone-produced tones. The combination lets a computer serve as an answering machine or the voice equivalent of an e-mail system. However, many possible ways exist to implement this concept and create a voice mail system. Ideas also vary concerning which functions to include in such a system, and at present the field is far from standardized. For example, what we choose to call a voice mail system is also referred to as both a phone

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SINGLE- AND MULTILINE  
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SYSTEMS SPAN A RANGE OF
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PRICE AND PERFORMANCE  
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SUITABLE FOR PERSONAL
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AND BUSINESS TASKS.  
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THE RECEPTIONIST VOICE MAIL SYSTEMS

mail or a voice processing system.

Historically speaking, computer-based voice mail systems owe their existence to two inventions: the Touch-tone telephone and the ability to digitize voice recordings using a computer. Though computer digitization of voice recordings has been around far longer, it wasn't until the invention of the tone phone in the '60s that phones and computers could communicate. In the two decades that have elapsed since the invention of the tone phone, tremendous breakthroughs in computer technology have taken place, and the quality of computer-digitized voice production has improved immeasurably. Until relatively recently, voice digitization techniques couldn't produce anything that sounded better than horrible, choppy speech with relatively long pauses. And it took a mammoth computer to produce even that.

Though we are confining ourselves to PC-based voice mail systems in this article, a wide variety of systems with a broad

range of features and capacities are available on all sizes of computers. These features are described at greater length in the glossary of terms provided on the following two pages.

As you would expect, voice mail capabilities have been available on larger computers far longer than they have been on PCs. The most expensive mini- and mainframe-based systems can store hundreds of hours of messages and can handle 100 or more incoming phone lines. Such systems are suitable for hundreds or thousands of in-house users. PC-based systems, on the other hand, though offered in a wide range of configurations, may be designed for only one user. The prices of all voice mail systems vary by several orders of magnitude, with the high end priced at well over \$1 million and the low end at \$269. Most of the systems—including several that are based on the PC—cost between \$15,000 and \$120,000.

Of the seven PC-based packages re-

viewed here, prices range from \$269 to \$24,000. At the low end are BignOuth, Watson, and The Complete Answering Machine. Each of these consists of software plus a board that plugs into your PC, each costs under \$400, and each can handle only one phone line. (Hyundai has also announced a low-end system called TIPPS that was not available for review at the time of this writing.)

At the high end of this group is *nita* Receptionist. *nita* is sold only through value-added resellers (VARs) as part of a complete system, including a computer. *nita* can cost anywhere from \$12,000 to \$24,000 and can handle anywhere from 4 to 16 phone lines, depending on how it is configured.

Between these extremes are 3 two- and three-line packages—IBM Voice Communication Adapter with Voice/Phone Assistant, VBX, and Voicemail—with prices that range from about \$1,150 to \$5,000.

■ VOICE MAIL SYSTEMS

PRICE MEANS CAPACITY Significantly, throughout the range of voice mail systems—from PC based to mainframe based—price differences are a better indication of capacity than of message-handling features. This similarity of function means that, in some cases, high-end PC-based systems can be functionally competitive with larger systems.

Though the functions available in many systems are similar, they are by no means identical, and the capabilities of one vendor's voice mail system may differ greatly from those of another. Confusing matters further, the name for a given function varies from one voice mail system to the next. For example, the ability to transfer calls to your choice of phone extensions is variously known as auto- or automated attendant, auto- or automated receptionist, auto- or automated operator, call routing, and call processing. But at least one manufacturer also uses "call processing" to refer to the overall capability to transfer calls and record messages.

We've created a glossary on voice mail terminology so that we can be consistent throughout this review. However, please be aware that our definitions may not match what you'll run into in the real world.

AN ANSWERING MACHINE The single most important distinction in voice mail systems is between answering-machine functions, which are modeled on the answering machine, and in-house voice mail functions, which are modeled on e-mail. While answering systems replace the ubiquitous pink message slip, in-house voice mail systems take the place of the in-house memo. Usually a voice mail system will have one type of function or the other; some have both. Since the two approaches overlap in some areas, it's easy to get them confused. Yet it's important to keep the distinctions firmly in mind or you may wind up with a system that's inappropriate for your needs.

Systems geared to answering-machine functions do pretty much what you would expect: answer the phone, give a greeting, and take a message. In fact, when a single-mailbox system having such functions picks up a call, a caller may have a hard time distinguishing it from a traditional an-

VOICE MAIL SYSTEMS GLOSSARY OF TERMS

ACCESS CODE

A password entered into a voice mail system through a Touch-tone telephone or through a PC keyboard. Gives a mailbox owner in a multibox system control over his or her mailbox—to listen to incoming messages or change greeting messages, for example. Recipients of personal messages also use access codes to access messages left for them by another mailbox owner.

ANSWERING MACHINE

Voice mail functions modeled on those of an answering machine: picking up incoming calls, playing a greeting message, and recording a message from the caller. Many systems offering these functions also offer enhanced voice mail related functions such as the ability to leave personal messages, store messages in more than one mailbox, and forward messages to the mailbox owner at another location.

ANSWERING SYSTEM

Voice mail system with answering-machine functions.

AUTO-ATTENDANT

A feature included in many voice mail systems for routing incoming calls. When connected to an in-house phone switching system (PBX or equivalent), the auto-attendant can transfer callers to any phone extension. If there is no answer at the desired extension, the feature usually allows the system to retrieve the call and direct it to the mailbox set up for the extension.

CALL SCREENING/HOLDING

Call-handling options that let users tell a voice mail system how to manage calls. With call holding, the system takes messages without ringing the phone extension associated with that mailbox. When set for call screening, the system prompts

the caller for his or her name. The system then calls the appropriate extension and plays back the name, giving the mailbox owner the option of accepting or rejecting the call.

DISTRIBUTION FEATURE

The voice mail equivalent of mail-merging. The distribution feature lets you send a specific voice message—the equivalent of a mail-merge master file—to everyone on a given distribution list—the equivalent of a mail-merge data file. Sometimes called broadcasting, distribution messages can be slated for internal or external distribution.

EXTERNAL DISTRIBUTION

An enhanced answering-machine function that lets a system with outgoing timed-message capability send the same outgoing message to more than one recipient.

INCOMING MESSAGES

The name used to describe messages left in a voice mail mailbox. Also called inbound messages.

INDIVIDUAL MAILBOX GREETING MESSAGE

An option included in some multiuser voice mail systems that allows each mailbox owner to record his or her own message to greet callers directed to the mailbox. Individual mailbox greeting messages are always heard after the system-wide greeting message.

BULLETIN BOARD

A non-voice-mail application that relies on the same technology as voice mail and is often offered as part of a voice mail package or as an extra-cost option. An informational bulletin board is typically created using special-purpose mailboxes that deliver a greeting message but cannot accept an incoming message. A call-

er is guided through the special mailboxes with voice prompts such as, "For further information about stock market prices, press 1. For information about bond prices, press 2. To return to the opening message, press 3."

IN-HOUSE VOICE MAIL

Functions modeled on an electronic mail system, as opposed to an answering machine. In-house voice mail functions generally include the ability to send and receive messages, append to, and forward them. Designed primarily to allow a group of mailbox owners on a voice mail system to exchange messages among themselves, with few amenities for use by outside callers.

INTERNAL DISTRIBUTION

An in-house voice mail feature that lets a mailbox owner send messages to mailboxes on a distribution list.

LOCAL PHONE

A standard telephone that plugs directly into a phone connector on the board of many of the smaller PC-based voice mail systems. It lets you listen to incoming messages and also record greetings and other messages.

MAILBOX

Analogous to the physical mailbox where written messages are stored before being claimed, the voice mail mailbox is the software location where voice messages are stored in a voice mail system. Some voice mail system vendors also use the term to mean any node in a bulletin board or telemarketing structure.

MAILBOX OWNER

The person authorized to retrieve messages from a given mailbox in a multiuser voice mail system. Called subscribers or registered users in some systems.

MESSAGE FORWARDING

A feature that records an incoming message, calls you at another number, and plays the message for you over the phone. To avoid confusion if someone else answers the phone at that number, most systems include an announcement message requesting that you be brought to the phone to receive a message. Typically, the system will then wait for you to enter your password before playing the message.

MESSAGE NOTIFICATION

This feature allows voice mail systems to notify mailbox owners that a message is waiting. It may notify them by either calling them at another specified number, by using a beeper, or by turning on a message waiting light.

MULTIUSER ANSWERING MACHINE

A multiple-mailbox voice mail system with answering machine functions. Callers are prompted to identify the mailbox to which they'd like to be directed to leave their message. Some systems offer different levels of greeting messages, allowing both a system greeting message and an individual greeting message for each mailbox.

OUTGOING TIMED MESSAGES

An extended answering-machine function that lets a mailbox owner or system administrator record a message and specify the date and time it is to be delivered. Also called outgoing messages or timed messages.

PERSONAL MESSAGES

An option included in many answering systems that allows each mailbox owner to record different messages for different people. Using this feature, a mailbox owner can create, for example, one message for business callers and another for friends. Typically, a caller will sign on

with a special access code (given by the mailbox owner) which tells the system which message to play.

SYSTEM ADMINISTRATOR

The person responsible for all system set-up and mailbox maintenance in a multiuser system. On many systems, the system administrator has access to messages left in all mailboxes.

SYSTEM GREETING MESSAGE

The first greeting message a caller hears when a multimailbox voice mail system answers an incoming phone call. Typically, the caller can then move to a specific mailbox, which may have its own greeting message. Also called a system-wide greeting message.

SYSTEM OWNER

The recipient of all messages on a single-user voice mail system.

TELEMARKETING

A non-voice-mail application that relies on the same technology as voice mail, and is often offered as part of, or an extra-cost option for, a voice mail package. Similar to informational bulletin boards, telemarketing applications use special-purpose mailboxes that prompt users and dispense information. Unlike informational bulletin boards, telemarketing applications can record messages, typically in the form of orders. Inbound telemarketing involves recording order information from incoming calls; outbound telemarketing is used to call prospective customers.

VOICE MAIL

The general term that includes both answering machine and in-house voice mail functions. Sometimes referred to as phone mail or voice processing systems, voice mail systems accept commands from a Touch-tone phone.

■ VOICE MAIL SYSTEMS

swering machine. You're less likely to misidentify a multiuser, multimailbox system with answering-machine functions since most of these require callers to choose the mailbox in which they'd like to leave a message by typing in its number.

Besides allowing a second-level greeting message for each mailbox, most multimailbox systems let mailbox owners leave different greeting messages for different people. Using this personal message capability, you could, for example, leave one general-purpose greeting message for business callers, a second message for your spouse, and a third message for your most important client.

Another answering-machine function included in some voice mail systems is the ability to forward messages. (Don't confuse message forwarding with call forwarding, which lets you program your phone to reroute incoming calls to other extensions.) A system with message forwarding lets you specify another number at which to have your messages sent.

IN-HOUSE VOICE MAIL As a rule, voice mail systems offering in-house voice mail functions are designed for in-house use and tend to include more features than do systems offering answering machine functions. Like the electronic mail systems upon which they were modeled, systems with in-house voice mail functions let a group of registered voice mailbox owners send and receive messages among each other. Message-sending features include things like message forward, append and forward, and the ability to create distribution lists.

Forwarding lets you take a message you've received and forward it to other mailbox owners. Append-and-forward lets you add a comment to a received message before forwarding ("Hi, Bill. Here's a comment from Melanie I thought you'd like to hear."). Distribution lists let you record a voice message once and send it to a predefined list of mailbox owners.

As you might expect, the features of in-house voice mail systems can take time to learn, and the wealth of choices can leave an incoming caller feeling flustered. This makes an in-house voice mail system a poor substitute for an answering machine, despite the similarity of the function. In

most cases you can limit the system so it will accept messages only from mailbox owners.

REAL-WORLD COMPARISONS The traditional, nonautomated way of answering phones in many companies involves a human receptionist who answers the phone and then transfers the call to the appropriate person. If there is no answer, the call will typically bounce back to the receptionist or to a company message center.

A voice mail system with answering-machine functions can easily be worked into such a system: if you replace the message center with a multimailbox answering



■ **Be forewarned that it's easy to get carried away with the technology. If you set up an auto-attendant badly, you can easily frustrate callers and alienate customers.**

system, the caller can designate the appropriate mailbox with telephone-produced tones and record his or her message. With most packages you can have the receptionist come back on the line to warn the caller that he or she is about to be sent to an answering system.

It is possible to replace a human receptionist with the auto-attendant feature that many voice mail systems offer. Though these auto-attendants work both with machines that handle answering-machine functions and those that handle in-house voice mail, they are more appropriate for use with a multimailbox version of the former. Typically, after the system picks up a call, the auto-attendant prompts the caller to enter an extension or spell out the last name of the person he or she is trying to reach; it then attempts to transfer the call to the appropriate extension. Technically, an

auto-attendant module need do no more than this. However, most auto-attendants can take the call back if they receive no answer or a busy signal and redirect it to the proper mailbox in the answering module for recording a message.

Be forewarned that it's easy to get carried away with the technology. If you set up an auto-attendant badly, you can easily frustrate callers and alienate customers. Someone who doesn't understand the instructions for entering commands to the auto-attendant, someone calling from a pulse phone, or a person who is simply not comfortable talking to a machine may not stay on long enough to leave a message.

The best way to use an auto-attendant is sparingly. One way to avoid problems with incoming callers on in-house voice mail systems is to limit access. You can put the system on its own phone line, and give the number only to people who know about it.

Another approach is as the so-called secondary receptionist. This means having the human receptionist answer the phone and transfer the call to the proper extension. If there is no answer, the auto-attendant may give the caller the option of leaving a message, entering another extension, or being transferred back to the human receptionist. Once people are familiar with the system, you can give them the direct number for the auto-attendant.

RELATED FEATURES Several applications that rely on the same technology as does voice mail may be included either as part of a voice mail system or as an extra-cost option. The most common of these applications are informational bulletin boards and inbound and outbound telemarketing.

Informational bulletin boards let callers move through a series of information-only mailboxes. For example, a multiscreen movie theater could set up a bulletin board with information about each movie in a different mailbox. Callers might then be told to "Press 1 for more information about *Rocky I*, press 2 for more information about *Rocky II*," and so on.

Inbound telemarketing has features similar to those of an informational bulletin board and adds the ability to take incoming messages—typically order infor-

WHAT SIZE SYSTEM DO I NEED?

Buyers trying to choose a voice mail system often ask how large an office or how many people a given system can handle. Instead, you should ask what the system's telephone line capacity is. Your office's system capacity requirements depend on the maximum amount of voice mail traffic you anticipate.

Making traffic calculations isn't easy; many telephone industry consultants make their living calculating telephone capacity requirements. However, it's useful to understand how telephone traffic and line requirements are determined.

HOW MANY, HOW LONG The amount of telephone traffic your voice mail system will field is defined by two factors: how many incoming calls are directed to the voice mail system, and the average amount of time the system spends on each call. To calculate the system capacity required, you need to determine the largest number of calls the system receives in any one time period.

If you have a relatively small office, you can determine how many calls you receive in your busiest hour by keeping a log of all the incoming calls for several weeks. It's also helpful to record how many calls require messages to be taken. From this log you can determine the number of telephone calls you get in your busiest hour and/or the number of messages you must record in your busiest hour. (Unfortunately, this number won't tell you whether you are losing calls during a busy signal; only special electronic tools can supply that information.)

mation. An inbound telemarketing system should also let you set up question-and-answer mailboxes, ask a series of questions about an order—such as name, address, credit card number—and let you retrieve the answers as a unit.

Outbound telemarketing is best summed up as the phone equivalent of junk mail. If you've ever been called by a computer and asked if you know that al-



Telephone Traffic Capacity

(Table body gives traffic capacity values in CCS)

Probability of busy signal for a given call (Pb)

No. of lines	Pb = 0.01	Pb = 0.02	Pb = 0.05	Pb = 0.10
1	0.4	0.7	1.9	3.8
2	5.4	7.9	12.9	19.1
3	15.7	20.4	29.4	43.6
4	29.6	36.7	49.1	66.0
5	46.1	55.3	70.9	98.0
10	149.0	166.0	196.0	224.0
20	399.0	429.0	477.0	523.0

Determining the length of time the voice mail system will spend on each call is a little easier. This requires that you know the features that the voice mail system offers, as well as how long it takes to supply them. For example, if you want a voice mail system to function as an answering machine and record messages in place of a human-staffed message center, you might come up with a per-call time figure of 60 seconds (allotting 15 seconds for the system greeting message, 5 seconds to transfer the call, 10 seconds to play the individual greeting message, and 30 seconds to record a message).

Once you know the number of calls you receive during your busiest hour and the average length of time your voice

mail system will spend on each call, multiply the two figures together to calculate the maximum amount of telephone traffic your voice mail system will be called upon to handle. For example, if during your busiest hour each day the system must record messages for 30 calls and the average message length is 60 seconds, the maximum amount of traffic the system must handle is 1,800 call-seconds.

In the telephone industry, units termed centum call-seconds (CCS, or hundred call-seconds) are usually used. To figure your telephone traffic in CCS, divide by 100. In the previous example, the traffic would be 18 CCS.

Once the traffic level in CCS is known, the number of lines needed is determined using a standard capacity table such as the one shown here. The table lists the maximum CCS that a given number of lines can handle with a given probability (Pb) of receiving a busy signal. To use the table, you need to know the number of incoming calls per 100 you're willing to risk losing. In this chart, the range is from 1 out of every 100 (Pb = .01) to 10 out of every 100 (Pb = .1).

When using this table, find a traffic capacity value that is greater than or equal to the maximum requirements within the range of risk you chose. For example, if you need 18 CCS maximum and cannot afford to risk losing more than one call in every hundred, the table shows that you need four lines. Similarly, if you are willing to lose one call in every ten, two lines will do.

—M. David Stone

minum siding can save on heating bills, you've dealt with outbound telemarketing. There is some question as to whether this application does a better job of getting potential customers or alienating them.

Other, more distantly related functions include dictation, voice synthesis, voice recognition, voice-based database retrieval (controlled by telephone-produced tones, with data spoken over the phone),

and alarm messages (automatically dialing the police or other emergency numbers).

A WORD ABOUT PHONE LINES

Keep in mind that voice mail is a marriage between two different technologies, telephone and computer. Be sure to consider the phone side of the equation carefully. In the years since AT&T lost control over the

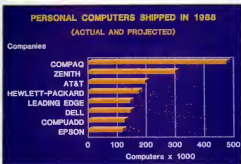
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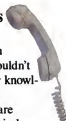
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■ VOICE MAIL SYSTEMS



Voice Mail System Board Anatomy



Natural Microsystems' proprietary BMC-1 chip for its firmware

A 16-bit processor by GI (a Taiwanese company) that functions as an optimizer for digital signal processing

Voice mail system boards borrow from and integrate proprietary and standard technologies from a variety of telecommunications sources including modems, PBXs, and standard phone answering machines.

Besides the features labeled on the photographs, the Watson board has a DIP switch used to set the port assignment of the board and the Hayes compatibility settings for modem communications; there is also an external speaker connector. BigmOut can accommodate two standard telephone jacks, an external speaker connector, and an event jack to generate an alarm signal for security systems. The Complete Answering Machine has an external speaker connector and a five-position DIP switch to control the port address and hardware interrupts.

Single-Line Systems



Watson (single-line) and VBX System (multiple-line)

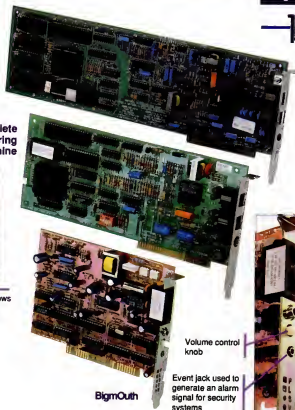
The Complete Answering Machine



Processor that allows CAM to operate in background mode

Gate array for the bus control interface

CAM's proprietary EPROM chip for its firmware



BigmOut

Volume control knob

Event jack used to generate an alarm signal for security systems



Two standard telephone jacks

External speaker connector

The IBM Voice Communication Option is built with RF shielding that covers half the board. The IBM board also features ten memory chips comprising the static RAM for program memory (eight have a 55-millisecond access time, while two have a 45-ms. access time) and three unique telephone jacks that IBM calls the Phone Line Interface (PLI). *nitaReceptionist* holds four "black boxes," called the Data Access Arrangement (DAA) that contain relays and transformers for the four lines it supports. Finally, the Voicemate 50 comes with a proprietary EPROM chip from Dialogic Corp., its firmware, an 80188 processor, and two connectors that allow additional communications options available from American Telesystems.

Multiple-Line Systems



Voicemate 50



16-bit TI processor optimizes digital signal processing

CAC 8512 Gate Array for the bus controller interface; replaces 5,000 individual circuits

IBM Voice Communication Option



Four daughterboards handle analog filtering for noise, control silence and pause compression during recording

nitaReceptionist



Intel's 16-bit 8546 chip hosts interface for PC communications

12.28-MHz oscillator determines speed of *nita's* processor chip

Daughterboard carries analog amplifier for analog processing

■ VOICE MAIL SYSTEMS

phone system, various manufacturers have been moving further apart in standards.

In particular, many manufacturers have developed proprietary standards for their PBXs (private branch exchange, or in-house telephone switching equipment). And there is no guarantee that any given voice mail system will work with every available PBX.

For example, all packages in this review were tested both on local phone company lines and on a Panasonic PBX. The PBX uses noticeably different signals from those of the local phone company for such functions as the ringback signal. Some packages had no trouble working with both sets of signals, while others needed fine tuning in order to work with one or the other. Moral: before committing to a voice mail system, make sure it will work on the phone system in your office.

Several high-end PC-based voice mail systems—such as the Brooktrout V-Mail 210—are not included in this review. Many manufacturers didn't want to be reviewed because they prefer to think of their products as part of the phone system rather than part of a PC.

As one manufacturer explained, these packages are sold exclusively by VARs, often as part of a complete phone system. They typically spend their lives hidden in a closet along with a PBX and are not available for use on a PC. Even the setup and system administration of these machines are often handled by the VAR. *nita* Receptionist (which is reviewed in this issue) is an exception in that system administration is often handled by the buyer rather than by the VAR.

The systems reviewed here cover a wide range: from single-line systems to 16-line systems; from answering systems to in-house voice mail; from auto-attendant to informational bulletin board; from inbound to outbound telemarketing. Even a low-end, single-line package can be an appropriate answer for a small office or department. Depending on how many calls the department handles, a single line may be enough for a dozen people or more. (See sidebar, "What Size System Do I Need?")

Often it may be less expensive to install several PC-based systems on a department-by-department basis rather than one

larger, more expensive system for the entire company. Even better, using smaller systems makes it easier to choose packages that best meet each department's needs. In any case, if a PC-based system will do the job, you'll likely find the right system in the reviews that follow.



TALKING TECHNOLOGY INC.

BigmOut

Talking Technology's BigmOut, at \$269, is a single-line system for people who like to roll their own. It can serve a variety of functions: a single-user answering machine; a multiuser, multimailbox system serving in-house voice mail functions, complete with auto-attendant for use on a PBX; an informational bulletin board; an inbound or outbound telemarketing system; or some combination of these. The complexity of the application is up to you.

Given its functions, getting started with BigmOut is surprisingly simple. Plug the

board into your computer; plug in a phone, an analog phone line, and the external speaker into the board, and copy the three program disks to the BigmOut directory you create on your hard disk.

From there it's up to you. The manual has separate chapters on each function, so you can study just those features you need to learn. The quick-start section will get you set up as a single-user answering machine in minutes. The one area not discussed is how to set up auto-attendant features for a PBX. However, Talking Technology offers free technical support to help you set up your applications.

Though the logic of BigmOut's organization is not obvious, it is easy enough to understand. For example, typically a voice mail system is structured so that you first choose a mailbox and then decide what to do with it. Indeed, that's precisely the logic BigmOut uses for incoming calls. When working from the keyboard, however, BigmOut reverses the logic; first you choose what you want to do, and then tell BigmOut which mailbox.

This is a little confusing at first, but it makes the creation of complex applications far easier than it would otherwise be. For example, if you are building an auto-attendant, you can create your mailbox structure, then go to Greeting Messages and record all mailbox messages at once.

SYSTEM ADMINISTRATION The on-screen portion of BigmOut is designed for the system administrator. In a single-user system, this is also the system owner; in a multiuser, multimailbox system, you can avoid confusion by letting individual mailbox owners communicate with BigmOut only by phone.

Privacy is another reason for limiting mailbox owners to phone access only. When working from the keyboard, you can listen to all messages in all mailboxes. Worse yet, because there is no password protection for the system, anyone with access to the computer has full access to BigmOut. For this reason you will probably want to equip the computer housing a multiuser system with a keylock. Since BigmOut operates in foreground only, a multiuser system will require a dedicated computer regardless.

In spirit, BigmOut is much like a

PC MAGAZINE EDITOR'S CHOICE FACT FILE

BigmOut, Version 2B

Talking Technology Inc.,
4383 Piedmont Ave., #B
Oakland, CA 94611

(415) 652-9600

List Price: \$269

Requires: 256K RAM, hard disk highly recommended; DOS 2.0 or later; IBM PC, XT, AT or close compatible; PS/2 Model 25, 30, or 35, or a 386 machine

Phone Requirements: One analog line, local Touch-tone phone. PBX transfer needs switch hook.

In Short: Although limited to handling a single line, BigmOut is a full-function package by any definition. It works as a single-user answering machine right out of the box and provides a set of tools for building more sophisticated applications. Much like a spreadsheet in spirit, BigmOut manages to be both flexible and relatively easy to learn.

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Generic
SOFTWARE

■ VOICE MAIL SYSTEMS

BigMouth Copyright (c) 1987 Talking Technology, Inc. 9-23-88 6:28:58PM

STATUS - Review Calls ↑ and ↓ Keys Set Ear, ← Plays and Aborts Messages

2 New Messages Answer on Ring 1 Distribution OFF Forwarding OFF

0 Hangups Speaker ON Alarm ON Local Phone OFF

▼ NEW Events Below ▲ OLD Events Above ▲ Start 6:28:44P 9-23

1	Greeting Message	Box 0	T= 00:02	6:18:08P	9-23
2	Out of Disk Message		T= 00:04	2:32:17P	4-85
3	Forwarding Message	Box 0	T= 00:07	5:33:25P	7-26
4	Personal Message	Box 0	T= 00:35	4:25:24P	9-23
5	Timed Message	Box 0	T= 00:18	6:11:82P	9-23
6	Old Msg #012	Box 0	T= 00:32	11:36:10A	9-19
7	Old Msg #013	Box 0	T= 00:32	11:37:11A	9-19
8	Old Msg #012	Box 0	T= 00:03	6:18:26P	9-23

DEL - Delete Msg F1 - Wait For Calls F3 - AutoDialer F6 - Print F10 - Exit
INS - Undelete F2 - Review Messages F4 - Review All F7 - Move ESC - Main

BigMouth's Review Calls screen gives you control over the incoming calls you're listening to. The top portion of the screen gives you the current system status—how many new messages you haven't yet listened to, what ring to answer, and so on. The lower section of the screen lists the type of message recorded—greeting, personal, outgoing timed—along with the length of the message (T = 00:02 is a 2-second message, for example) and the time and date the message was recorded.

■ Given its functions, getting started with BigMouth is surprisingly simple.

spreadsheet, providing a foundation and a set of tools. To build a mailbox structure, you go to the misnamed Phonelist on the main menu. Each entry in the phone book is a mailbox and can be defined according to a specific function.

For example, to create a single-user answering machine, you might define a single standard mailbox with a general-purpose greeting along with several personal mailboxes so that you can leave personal messages for specific individuals. In a multiuser system, you could define several standard mailboxes.

Other types of mailboxes can transfer a call on a PBX, ask questions and record answers, or automatically jump to other mailboxes. They can even tell BigMouth to hang up, shell to DOS, run another program, and resume waiting for calls after the other program finishes. By determining the types of mailboxes you use and the way the boxes are linked, you can configure BigMouth to operate as an answering machine, an auto-attendant, or a telemarketing system.

BigMouth is simply full of options. From within the program you can select pulse or tone dialing, incoming message length, prefixes for dialing long distance or from a PBX, and even a second drive to use if the current drive is full. You'll also find an ASCII parameter file with about 25 additional settings that let you adjust technical details, such as how long to hold a switchhook flash for your PBX.

SETUP FOR THE CALLER How the system treats a caller or mailbox owner obviously depends on how you've set it up.

As shipped, the voice prompts are short but detailed enough so that new users—whether mailbox owners or callers—should have no trouble following them. Those who are familiar with the system can take the shortcut of typing commands before the prompts finish. Prompts are recorded in a clear male voice and can be replaced with customized messages.

When BigMouth is performing in-house voice mail functions, mailbox owners can send and retrieve messages as well as send outgoing timed messages. They can also change their passwords, change their greeting message, create new personal messages, and select message forwarding for their mailbox (if the system administrator has given them that option). Distribution messages can be created only from the keyboard.

Unfortunately, BigMouth suffers from marginally slow operation in some areas. When moving from mailbox to mailbox, for example, BigMouth takes time to load the message for each new mailbox from disk. The lag is even noticeable on an AT. For best response time, put the prompts and messages in a RAM disk in expanded or extended memory.

While BigMouth's voice quality is best described as thin and overcrisp, all recordings were clear and understandable.

Clearly, BigMouth qualifies as a full-function system. It is not the easiest single-line package to learn, but it is one of the most flexible. If you want to match your voice mail system to your needs as closely as possible and are willing to work toward that end, BigMouth is the obvious choice.

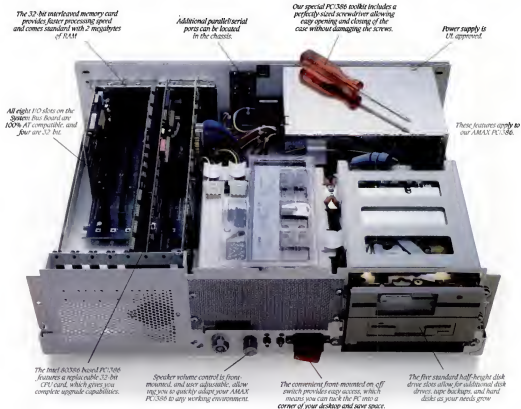


THE COMPLETE PC INC.

The Complete Answering Machine

The Complete Answering Machine, \$349 from The Complete PC, offers more than its name implies. While it can function as a single-user, single-mailbox answering

To Choose The Right Computer, You Have To Look A Little Deeper.



These days it seems a lot of PC makers would rather show you a beautiful outside than reveal what's behind it. But at AMAX, we're so proud of our line of high performance, IBM*-compatible PCs that we want the world to see exactly what makes them the best in the business, inside and out.

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at our best. Before an AMAX PC leaves the plant, all systems and components undergo rigorous testing and evaluation including an extended "burn-in" period at temperatures ranging from 110° to 130°F. And our commitment continues after the sale, with long-term technical phone support, quick turnaround service and a 12-month limited warranty.

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CIRCLE 179 ON READER SERVICE CARD

■ VOICE MAIL SYSTEMS



Voice Mail Systems: Summary of Features

(Products listed in ascending price order)

SINGLE-LINE SYSTEMS

MULTIPLE-LINE SYSTEMS

	Watson Natural Microsystems \$199 (\$399 with VIS)	Watson: Business Central Temple's Natural Microsystems \$190 (must be used with Watson)	Bigmouth Talking Technology Inc. \$269	The Complete Answering Machine The Complete PC Inc. \$349	IBM Voice Communications Office IBM Corp. \$995 (hardware), \$149 (software)	VBX System Natural Microsystems \$3,995
CONFIGURATION						
Lines per board	1	1	1	1	2	1
Boards per computer	1	1	1	4	1	2
Recommended number of users	1-25	5-25	1-100	15 per board	1	20-100
Background or foreground operation	Both	Both	Foreground	Background	Foreground	Foreground
On-board modem	●	●	○	○	●	●
Can share line with external modem	○	●	●	●	○	●
Can share line with fax board	○	●	●	●	○	●
Connector for external speaker	○	●	●	●	●	●
Volume control directly from board	○	○	●	○	●	○
ANSWERING-MACHINE FUNCTIONS						
System greeting messages	●	○	●	●	●	○
Stores multiple greeting messages	●	○	●	●	●	○
Can be modified from remote location	●	○	●	●	●	○
Customized mailbox greeting messages	●	○	●	●	●	○
Maximum number of messages	Varies*	N/A	1	99	Unlimited	N/A
Can be modified from remote location	● ¹	N/A	●	●	●	N/A
Incoming messages						
Total mailboxes available	750	250	300	999	1	250
Limit on number of messages	700	700	Disk space	Disk space	Disk space	500
Personal messages	●	○	●	●	●	○
Remote retrieval (with security)	●	●	●	●	●	●
Automatic deletion after a user-specified time	● ¹	○	○	○	○	○
MULTIUSER FEATURES						
Mailboxes						
Can link mailboxes	● ¹	○	●	● ²	○	○
Forwards messages to other mailboxes	●	○	○	●	○	○
Allows user control over security code	●	○	●	●	○	○
Auto-attended transfers calls to a different extension	●	○	●	●	○	○
Without leaving a message	● ¹	●	●	○	○	●
After leaving a message	● ¹	●	●	○	○	●
OUTGOING MESSAGES						
Sends messages at user-specified times	●	● ²	●	○	○	● ¹
Holds for a specific person	●	○	○	○	○	○
Asks for a response	● ¹	○	●	●	○	●
Transmits message to several people	○	○	●	○	○	○
Number of names in distribution phone book	750 ¹	None	300 per phone book	None	None	None
Number of distribution lists allowed	3 ¹	None	1 per phone book	None	None	None
MESSAGE FORWARDING						
Can deliver messages by dialing a number, asking for a person, and waiting for a command	●	●	●	●	○	●
ADDITIONAL FEATURES						
Dictation machine	● ¹	● ²	○	○	○	○
Auto-dialing for voice calls	● ¹	○	●	●	Optional	○
Voice synthesis*	Optional	○	○	○	Optional	○
Alarm messages	○	○	○	○	○	○
Telephone as a remote terminal	Optional	○	Optional	○	Optional	○
International bulletin board	●	○	●	○	○	●
Inbound and outbound telemarketing	● ¹	○	●	○	○	●

●—Editor's Choice ●—Yes ○—No N/A—Not applicable; this product does not offer customized messages.

*Messages are available only with VIS; the maximum number depends on the number of mailboxes. ¹Only with VIS. ²System administrator only.

Volcomat 25 American Telesystems Corp.	Volcomat 50 American Telesystems Corp.	airReceptionist innovative Technology Inc.
\$3,995	\$5,995	\$12,000 and up

2	3	4
1	1	4
10-40	25-70	20 and up
Foreground	Foreground	Background
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
N/A	N/A	2
N/A	N/A	
40	75	575
1 1/2 hours	2 1/2 hours	Disk space
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

○	○	○
○	○	○
○	○	
○	○	
○	○	○
None	None	None
None	None	None

●

```

NDM MESSAGES          7 MESSAGES          Saturday 09/24/98
Mailbox 18           04:37 PM

#      Date Rec'd      Time Rec'd      Length      Status
--      -
1      09/24/98        15:49          00:06       Save
2      09/24/98        15:52          00:15       Save
3      09/24/98        15:55          00:05       Delete
4      09/24/98        16:35          00:08       Send
5      09/24/98        16:35          00:07       Delete
6      09/24/98        16:36          00:06
7      09/24/98        16:36          00:04

Choose message with arrow keys and select function

# F1 	> Help      # F4 	> Save      # F7 	> Replay      # F10 	> Save
# F2 	> Skip      # F5 	> Spkr (On ) # F8 	> Replay 8 sec # Exit
# F3 	> Listen    # F6 	> Delete    # F9 	> Send       # ESC 	> Exit

```

The CAM message screen is divided into three sections with summary information on top, a list of messages in the middle, and function-key commands on the bottom. The Status entry for each message gives you the choice of deleting the message, saving it as an old message, or sending it to another mailbox; CAM defines a new message as one that you haven't disposed of yet. CAM can also send a message to another mailbox while simultaneously deleting or saving it in the current mailbox.

machine, it's perfectly suitable for a multiuser, multimailbox system. In either guise you'll find a machine that offers useful answering-machine features and is even able to work with PBXs on a limited basis. You won't find many in-house voice mail functions in CAM, though, and given its name, you oughtn't expect to.

Whether you plan to use CAM as a single- or multimailbox system, setup is standard. Plug the board into your computer, plug the phone line and local phone into the board, and, optionally, plug in a battery-operated speaker (available at Radio Shack). You then start the computer, run a diagnostics program to confirm that the board works properly, and finally use CAM's install program to set parameters and copy the files to your hard disk.

CAM is ready to work as a single-mailbox system right out of the box. To set it up as an answering machine, simply start the program: it comes with a prerecorded greeting and a full set of prompts. As shipped, all prompts and greetings are re-

corded in a pleasant female voice. You cannot customize the prompts, but you can easily create customized greeting messages. Voice quality is good; all recordings are easily understandable.

MULTIPLE CHOICES CAM manages its split personality well. You can ignore system administration and multiple mailboxes until you have reason to use them. To set CAM up as a multiuser, multimailbox system, choose Mailbox Maintenance from the main menu and you can create as many mailboxes as needed. You can modify the settings for each mailbox or leave that task for the mailbox owner.

A background module in CAM answers the phone, records incoming messages, and lets you control CAM by phone. A foreground module lets you control CAM from the keyboard using nested function-key menus.

Although these on-screen menus are easy to use, the logic behind their organization is not always clear. For example,

■ VOICE MAIL SYSTEMS

Listen to Messages is a first-level choice, while Record Greeting is a second-level choice under Personal Options.

This hierarchy presents no problem once you know where features are hidden; and the menus are so simple enough to navigate through that you can browse through them if necessary. Luckily, context-sensitive help is always available with enough information so that you'll rarely reach for the manual.

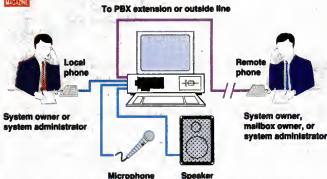
Interestingly, the voice menus are easier to use than the on-screen menus. When dealing with CAM by phone, the long but informative voice prompts will guide you without problems. Once you're familiar with them, you can enter commands without listening to the full prompt.

Keep in mind that if you create additional mailboxes, you should give instructions for using them. If you forget, or if the caller feels intimidated or is calling from a pulse phone, CAM will record the message in the system administrator's mailbox.

All features are available from both keyboard or phone except for system administration functions, which are available from the keyboard only. The system administrator can determine which features will be available. These include outgoing



Basic Voice Mail Topology



All single-line systems and some multiline systems include a local phone for easy recording of greeting messages and outgoing messages, and for listening to incoming messages. Most systems let mailbox owners control the system from a remote phone as well. Single-line systems often give more control from the keyboard and local phone than from a remote phone,

with some or all system administrator functions under keyboard control only.

Multiline systems that lack a local phone often carry connectors for a microphone and speaker on the board. They may also let you call the system and record greeting messages and other systemwide messages while you are controlling the system from the keyboard.

timed messages, message forwarding, remote access for mailbox control, and even whether CAM will take messages at all. Only the system administrator can create or delete mailboxes.

One of CAM's nice touches is the ease with which it lets you manage multiple greeting messages. Record greetings as you need them—for day, night, or holidays. CAM will store all of them and let you select them at the appropriate time. On a multi-mailbox system, you can store multiple messages in each mailbox.

Although you can run CAM in background, you will be acutely aware of CAM when it is doing its stuff. Because CAM takes over during disk operations, it will momentarily interrupt you when it is loading a prompt into memory or recording a message. Whether you consider this acceptable depends on how many calls come in each day, how much foreground work you do on the computer, and how tolerant you are of interruptions. In most cases you will want to use CAM in a dedicated system.

PBX DEALINGS CAM's limited ability to deal with PBXs allows it to wait for an outside line when dialing and to transfer calls to another extension. If you can program your PBX to return unanswered calls to CAM, you can cobble together a kind of poor man's auto-attendant feature, although CAM is not designed for auto-attendant operations.

Also be aware that you can use up to four CAMs in a single computer for multiline operation. However, this too is a cobbled-together solution. You need to install a separate program for each board, and none of the messages or mailboxes in one CAM are accessible from the others.

A final feature worth noting is CAM's ability to share a single phone line with the The Complete PC's Complete Fax (CFax) board. If you assign the fax board its own mailbox, callers can go through CAM to reach CFax.

CAM also offers limited in-house voice mail features, including the ability to forward incoming messages to other mailboxes but without added comments. Simi-



FACT FILE

The Complete Answering Machine, Version 2.1

The Complete PC Inc.
521 Cottonwood Dr.
Milpitas, CA 95035
(800) 634-5558
(408) 434-0145
List Price: \$349
Requires: 384K RAM, hard disk, DOS 2.1 or later.

Phone Requirements: One analog line, local Touch-Tone phone, PBX transfer needs switch hook.

In Short: Somewhat more than its name implies, CAM includes such enhanced answering-machine functions as message forwarding and timed messages. Although it lacks some related features such as distribution lists or bulletin boards, it offers the quickest route to building a multimailbox answering system.

CIRCLE 600 ON READER SERVICE CARD

Read It And Reap.

TO: Any one interested in writing improvement
FROM: Ken Dickens, ad writer

RE: Writing improvement with NEW Grammatik III, a demo disk, and a contest to get both ABSOLUTELY FREE

"Software to easily help me write more better (not just easier or faster, but "better")?" "Right, Don." That's what I said last year when the president of Reference Software bet a gourmet lunch that Grammatik II could help even me. I lost. He ate quail eggs. I ate crow.

Now there is Grammatik III. Don says "it's a super whiz-bang high-tech expert system artificial intelligence writing improvement program that makes Grammatik II (and all other grammar checkers) look like Dick and Jane readers. He wants to bet lunch again.

What should I do?

He says Grammatik III actually "proofreads" your writing (how can it do that?) for errors in grammar, style, usage, and spelling. It can recognize nouns, verbs, adverbs, articles, adjectives, and pronouns so it catches a number of problems no other grammar or spelling checker can. It's simple too use. Give Grammatik III your document's name. Watch it work, right on the screen (it can't be that easy, can it?). He says it identifies writing problems, offers suggestions for improvement, and get this, lets you ignore the suggestion and continue, or make changes in your document immediately. Without ever going back to to your word processor.

Then he gave me this example, (which I don't believe even for a minute): Grammatik III might stop on a sentence like "It's a long way to Tipperary", tell you that the word following "It's" is usually incorrect after an possessive pronoun, and suggests "It's" instead.

I laughed. I knew it was impossible. Don smiled and very calmly explained that although Grammatik III is not perfect, it finds errors like incomplete sentences, improper use of homonyms (like "their" instead of "there"), split infinitives, subject/verb and noun/modifier disagreements, passive voice, and etc. It even catches unbalanced punctuation, doubled words, transpositions (like form/from). . . . He went on for fifteen minutes.

Software can't do that. Can it? But if it did. . . better writing brings big bucks (and I do have three kids to support). Should I take the bet? I'm confused. Help! Before I try it, tell me if Grammatik III helps your writing. Enter this contest (the details are below), try Grammatik III free, and let's discuss it over dinner. In San Francisco.

POSSESSIVE ERROR, ONLY 18 TO GO, GOOD LUCK

Ken Dickens

FREE DEMO!



The Contest Everyone Wins.

New Grammatik III found nineteen practical ways to improve this memo in just over one minute. If you can circle the same problems and explain what the problems are, we'll send you Grammatik III absolutely free. Go ahead, try it. Because even if you miss them all you'll receive a FREE Grammatik III demo disk just for entering. And, you'll automatically be entered in our "Dinner in San Francisco" drawing! The contest is great, but here's an even

faster, easier way to get better writing. Order Grammatik III right now for only \$99 with our "30-Day Write Better or Your Money-Back Guarantee." New Grammatik III. It's the risk-free way to reap the rewards of better writing.

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Gram-mat-ik III
Powerful Writing Improvement



☐ Here's my contest entry. Please send me a FREE Grammatik III demo disk (\$4.95 value).
☐ Please send me _____ copies of Grammatik III for \$99.95, plus \$7.50 shipping (\$10 per unit outside USA/CA residents add applicable sales tax).

Enclose \$ _____ ☐ VISA ☐ MC ☐ AMEX
Card # _____ Exp. _____
Name _____
Company _____
Address _____
City/State/Zip _____
Phone (_____) _____
200 Townsend St. Suite 122, San Francisco, CA 94107

30-Day Money-Back Guarantee

Reference Software

*RightWriter owners call for special \$295 trade up offer or get a FREE copy of Grammatik III if RightWriter finds all the mistakes on the above letter. Grammatik III owners call for low cost upgrade. *Limit one (1) free Grammatik III package and Grammatik III demo disk per person address. San Francisco trip is for 20 and includes round trip airfare from anywhere in the continental U.S., one night hotel accommodations, and dinner with Don Dickens and Ken Dickens. Travel arrangements will be made by Reference Software. *Contest ends March 31, 1990. Drawing to be held from all entries postmarked before March 15, 1990. *Contest ends using Grammatik III will be disqualified. Grammatik is a trademark of Wang Laboratories. Reference Software is a trademark of Reference Software, Inc. © 1989

CIRCLE 249 ON READER SERVICE CARD

All New Version
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■ VOICE MAIL SYSTEMS

larly, it will let you create an ad hoc list of up to 25 recipients for outgoing timed messages but has no distribution list feature.

These limitations are reasonable for a \$349 product called the Complete Answering Machine. The brilliance of CAM's design is its ability to fit well enough into a large range of situations, from the single user to the small office. That flexibility, combined with an admirable ease of use, earns it high marks.



IBM CORP.

IBM Voice

Communication Option

The IBM Voice Communication Option, which comprises the IBM Voice Communication Adapter (VCA) and the IBM Voice/Phone Assistant, was one of the first hardware/software combinations to turn a PC into an answering machine. Available since 1985, they differ from every other product reviewed here in that they are not sold as a bundled package.

The \$995 VCA was intended as a multipurpose board, suitable for voice synthesis, voice recognition, telephone management, and even asynchronous communications as a 2,400-bit-per-second modem. In keeping with its multipurpose intent, the board was released along with several standalone programs. One of these is the \$149 IBM Voice/Phone Assistant.

The Voice/Phone Assistant was designed as an entry-level program, meaning a single-user, single-mailbox answering machine with personal message capability. Unfortunately, IBM has never added any new VCA programs to its original set—the Assistant's entry level answering machine is still the only voice mail option available.

Installing the VCA is more cumbersome than it should be. Besides plugging in the card, you have to run the diagnostics routine and system tests from the diagnostics disk. You also have to install the IBM Voice Communications Operating Sub-

Unheard messages: 1		Line 1 Status INACTIVE	Line 2 Status INACTIVE
---------------------	--	---------------------------	---------------------------

Voice message list						message 1 of 19
Date	Time	Duration	File Name	Guest ID	Comment	
A 09/27/88	10:58a	00:33	Stdgreet.		Standard Greeting Msg	
U 09/27/88	10:55a	00:22	an000006.nm			
09/27/88	11:48a	00:38	an000009.nm			
09/27/88	11:45a	00:38	an000006.nm			
09/27/88	11:43a	00:22	an000007.nm			
09/27/88	11:42a	00:04	Holgreet.		Holiday Greeting msg	

Define File	
Filename	:(Vacgreet)
Comments	:(Use while on vacation)
Guest ID	:()
Voice storage type.(1/2/3):(2)	

Press F10 to Continue

Listen	Record	Erase	Prefix	Append	Modify List
--------	--------	-------	--------	--------	-------------

Esc-Previous F1-Help

The IBM Voice/Phone Assistant message screen shows all messages on the system. Note that the greeting messages are identified with a comment; the pop-up Define File menu lets you record greeting messages. The currently active greeting message is identified with an A in the far-left column. The Voice Storage Type option lets you choose between low compression recording for highest quality or high compression for minimum disk space usage. The default setting as shipped is 2, a compromise.

system that comes with the board. And rather than letting you use standard modular phone cables, IBM supplies its own cables with specially notched connectors. You can plug in one phone and either one or two phone lines, although the program will answer only one line at a time (callers to the other line will hear a ringback signal).

To install the software, you have to copy the original disk to a backup floppy and then run the install routine from the backup. Although the original disk is not copy protected, it is write protected. You can't install the program directly from it because the install routine needs to write to the floppy. This seems unnecessarily clumsy, but at least it forces you to make a backup of the program.

EASY, YET CUMBERSOME Using the Voice/Phone Assistant is much like installing it—easy in some ways, cumbersome in others. On the plus side, the structure is a model of simplicity. The main menu offers

five options, and only three of these relate to voice mail: Setup, Start Answering Phones, and Voice Message List. On the minus side, the logic behind the structure is not always clear.

For example, to set up the system as an answering machine, you choose Voice Message List from the main menu, record a message, choose Modify List, and designate the message as your greeting. But even this procedure is plagued by stumbling blocks—it's far from obvious that you should choose Modify List to designate a greeting message.

In cases where the program logic is obscure, there are usually few enough choices that you can browse through each until you find what you want. The context-sensitive help also does a good job of explaining each choice.

Unfortunately, using the Voice/Phone Assistant by phone is much more difficult than using it from the keyboard. Although some of the commands are mnemonic (N for Next message, B for Begin playback),

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LAN183-4	183	27	DCB
LAN285S	286	17	SCSI
LAN335E	338	16	ESDI
LAN650E	651	16	ESDI
LAN2 (Internal)	183-366	27	DCB
LAN2 (External)	286-572	17	SCSI
LAN4 (Internal)	183-733	27	DCB
LAN4 (External)	286-1144	17	SCSI

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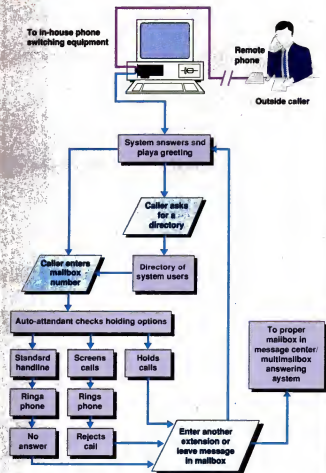
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Storage Dimensions, 2145 Hamilton Avenue, San Jose, CA 95125

CIRCLE 161 ON READER SERVICE CARD



Voice Mail System with an Auto-attendant (as seen by an outside caller)



This diagram shows how a voice mail system with an auto-attendant is seen by an outside caller. The auto-attendant directs incoming calls to the proper extension or screens or holds calls as requested. If there is no answer, the auto-attendant will give the caller the option of trying another extension or of being sent

to the proper mailbox in either the system message center or the multimailbox answering system. Most systems will transfer calls to a human receptionist, as well.

Auto-attendants work with either answering machine or in-house voice mail systems but tend to work best with systems that perform answering machine functions.

others are not (X-1 for primary command, X-2 for secondary commands). Even worse, the voice prompts are essentially nonexistent.

When you call your system, you interrupt the greeting message by entering your password; then the Assistant automatically plays your most recent message. If you want to do something else—listen to other messages, change the greeting, or create a personal message—you have to know the commands.

You can ask for a list of commands, but first you have to know the command to get the list. Worse, the help message is generated as a synthesized voice from ASCII text and is not customizable by the system owner. This saves a great deal of disk space, but it's difficult to understand over the phone. However, the remote commands are explained well in the manual, which makes up somewhat for these problems. The program also comes with a reference card that is far too large to fit comfortably in a wallet.

The real problem with the confusing telephone-produced tone commands and the lack of voice prompts is for so-called guests—meaning those whom you've given ID codes for personal messages. Once signed on as a guest, a caller cannot listen to more than one personal message or



FACT FILE

IBM Voice Communication Option

IBM Corp.
11400 N. Burnet Rd.
Austin, TX 78758
(800) 426-2468
(512) 823-0700

List Price: VCA board and operating system, \$995; IBM Voice/Phone Assistant, \$149
Requires: 192K RAM (320K for use with voice prompts, 512K recommended); hard disk recommended, DOS 2.1 or later.

Phone Requirements: One or two analog lines, local phone. Will not work with PBX.
In Short: At \$995 for the VCA board and \$149 for the software, IBM's voice mail entry is overpriced and underpowered. Although it has connectors for two phone lines, it can answer only one at a time, and its single-user answering-machine features are far outclassed by packages costing one-fourth the price.

CIRCLE 88 ON READER SERVICE CARD

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Its footprint is small enough to fit on an airline tray table, with room to spare.

erals. You can even add a 12-MHz 80C287 coprocessor as an option to speed number crunching.

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Best of all, the COMPAQ SLT/286 just snaps right into the Desktop Expansion Base. No cord. No wires. No hassle.

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Gbs5spBack-0012

Back

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Before now, choosing a laptop PC meant choosing what you could live without. A manageable size. Battery. Power. Speed. Screen quality. Full-size keys.

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The COMPAQ SLT/286 snaps into an optional Desktop Expansion Base for office use.



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It simply works better.

leave a message unless he or she knows the right commands. Callers who do not use an ID code for personal messages are automatically routed from the system greeting to leaving a message, as with an answering machine.

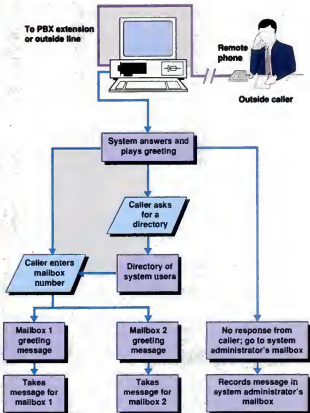
The *Voice/Phone Assistant* will let you choose from three levels of voice compression. All three levels yield adequate speech quality, but no more. Even the high-quality voice recording has a distinctly hollow sound, and all three levels record with a buzz in the background.

The VCA board may be more interesting for other uses. For example, IBM's Augmented Phone Services program, AUG, lets speech-impaired users communicate over the phone by generating synthetic speech from ASCII text. AUG can also help hearing-impaired users communicate by letting callers type words on telephone's tone keys.

As a voice mail product, the combination of VCA and *Voice/Phone Assistant* just doesn't offer as much as its competition. It's not only that other computer-based packages do more for less money, but that even an answering machine can do almost as much for one-tenth the cost. And the answering machine won't tie up your computer while it is doing its stuff.



Voice Mail System Topology (as seen by an outside caller)



This is a simplified view of a typical multiuser, multimailbox voice mail system performing answering machine functions without an auto-attendant. An outside caller who wants to leave a message first listens to the systemwide greeting message, then can choose to enter a mailbox number or get a directory listing of mailboxes.

After listening to the mailbox greeting message, the caller can leave a message for the mailbox owner. Because some

callers may become flustered or may be calling from pulse phones, most systems will send the caller to the system administrator's mailbox, where the caller can leave a message that will be forwarded to the proper recipient.

A multiuser, multimailbox system performing in-house voice mail functions will have a similar topology, but each mailbox is less likely to have individual greeting messages. Such systems are less useful for recording outside calls.



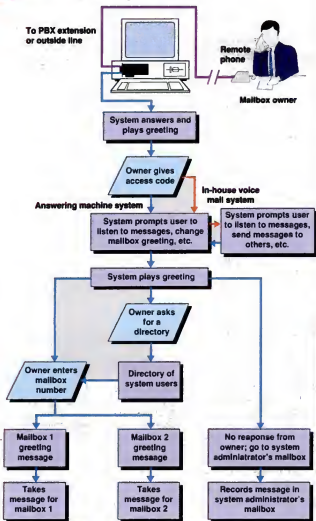
INNOVATIVE TECHNOLOGY INC. nitaReceptionist

Given its ability to handle 4 to 16 phone lines (with 4 lines per board) and its price of at least \$12,000, *nitaReceptionist*, from Innovative Technologies, clearly qualifies as a full-scale system. And given the "receptionist" part of the name, it's no surprise that the emphasis is on auto-attendant and message center features. If those are the functions you're looking for, *nita* is the system to look at. Despite its price, however, *nita* at present does not offer in-house voice mail functions, although those features are promised.

Like its less ambitious cousins, *nitaReceptionist* consists of software plus a board



Voice Mail System Topology (as seen by a mailbox owner)



From the mailbox owner's point of view, systems performing answering machine functions are similar to those performing in-house voice mail functions. The main difference is that in an answering machine

system, the mailbox owner must go back to the system greeting message to leave messages for others, as would an outside caller.

that plugs into a PC. However, unlike most such PC-based systems, you have to buy the computer as part of a package sold only through VARs.

The \$12,000 base price is for one *nita* board in a 286 computer, plus installation and training. The system supplied for review included an ITT Xtra—a 16-MHz 386 machine equipped with a 60MB hard disk, an EGA monitor, and 2MB of RAM—along with four *nita* boards; all together, a system that would cost \$24,000. Even among 386-based systems, prices will vary depending on the computer and the number of *nita* boards.

Because *nita* is dealer installed, difficulty of installation is not an issue. Installation includes setting up mailboxes and recording greeting messages; once these are set up, the dealer teaches the system administrator how to make further changes. For this review, ITI came to PC Labs to set up the system.

The *nita* operations modules—including auto-attendant and message taker—operate in background. The mailbox manager and other administration modules operate in foreground. This lets the system administrator manage *nita* even



EDITOR'S
CHOICE

FACT FILE

nitaReceptionist, Version HV26FEB88

Innovative Technology Inc.

1000 Holcomb Woods Pkwy., #422

Roswell, GA 30076

(404) 998-9970

List Price: \$12,000 and up, including cost of system unit, which varies depending on the dealer configuration. Minimum system is a 286 with a 20MB hard disk, DOS, 640K RAM.

Requires: 350K RAM (640K recommended); EMS to 2MB recommended; DOS 3.0 or later.

Phone Requirements: Four to 16 analog lines. PBX transfer needs switch hook.

In Short: By far the most expensive of the products reviewed here, *nitaReceptionist* is also the most ambitious. As the name implies, the auto-attendant feature is one of *nita*'s strengths. Able to handle four phone lines per board and up to 16 lines per computer, *nita* is less a PC-based system than a full-scale voice mail system that happens to run on a PC.

CIRCLE 68 ON READER SERVICE CARD

while *nita* handles the phones. It will also let you run application programs in foreground—although ITI doesn't recommend it, since crashing your computer will also crash your phone system.

ADMINISTRATIVE NIGHTMARES

nita's administrative functions were designed to give users a great deal of power, but with almost no concern for ease of learning or ease of use. For example, modifying system settings is a simple matter of filling in fields, but many require arcane definitions or arbitrary codes that aren't available as on-screen help. As a result, *nita* looks like a typical mainframe program, lacking the amenities that PC users have come to expect. ITI promises that the next release will be easier to use, with redesigned screens and on-screen help.

Another problem is the manual, which is so badly organized that finding anything is a challenge. Although the manual is meant for dealers, it must also serve as a guide for the system administrator, since ITI offers nothing else. ITI is acutely aware that this is a problem and has rewritten the manual for the next software release.

If you can find the information you need, system administration is straightforward. Adding or modifying a mailbox involves entering the user name, the PBX extension, the user code (which need not be the same as the PBX extension), and any of several options.

The two most important system administration options let you link mailboxes or link IDs. Linking mailboxes lets one user with multiple mailboxes retrieve all messages at once; linking multiple IDs adds flexibility. For example, you can let callers enter a user's last name, initials, or phone extension and still be routed to a single extension or mailbox.

The system administrator can also assign a message notification option. This is best reserved for such functions as printing a notification, turning message lights on if your PBX allows it, or calling a beeper. Though verbal notification is also a choice, it is not as useful as it might be.

The biggest problem with verbal notification is that *nita* has problems calling outside lines. *nita's* configuration files are tailored to your specific PBX. When dialing

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Performance Tests: Voice Mail System Sound Quality

Telephone lines, like TV speakers, are not designed to the high-fidelity standards of a home stereo system. Nonetheless, it's easy to recognize the gravelly, wavering, hissy, and certainly unbusinesslike messages that often emanate from inexpensive cassette-based answering machines. Since poor sound quality can degrade even the limited audio performance of telephone communications, we've tested the voice mail systems in terms of their capabilities as digital audio record/playback devices. Our measurements disclosed audibly significant differences between the best and worst units and correlated well with the subjective impressions noted in the individual reports.

We used an Audio Precision System One—the recognized standard instrument of the audio industry—to generate and analyze the necessary signals for tests of frequency response (with the results graphed here), as well as total harmonic distortion (THD+N) and signal-to-noise (S/N) ratio. One of the seven voice-mail systems—The Complete Answering Machine, from The Complete PC—could not be tested because it interpreted our test tones as dial tones and immediately hung up.

At best, the human ear can hear frequencies between 20 Hz (deep bass noises) and 20,000 Hz (high musical overtones of bells, triangles, and the like). The complex sounds of human speech generally

fall into the 100- to 10,000-Hz range, while telephone lines generally restrict transmission to a bandwidth of 300 to 3,300 Hz.

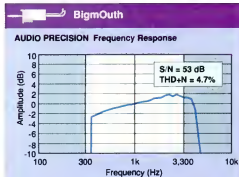
An ideal record/playback device for telephone communications would process all frequencies within the 300- to 3,300-Hz bandwidth identically, neither emphasizing some nor diminishing others. As you'll note in the graphs, however, the units we tested show some variations in their response to different frequencies. These variations are conventionally expressed in decibels (dB) with respect to a reference frequency (1,000 Hz). Differences of plus or minus 3 dB will almost certainly pass unnoticed on a telephone system, but losses (or gains) of 6 dB or more can affect the tonal character of the voice and may affect intelligibility in marginal situations.

The *nitareceptionist* gave the widest and flattest frequency response, varying by less than ± 1 dB from below 300 Hz to 3,800 Hz. On the other hand, the BigMouth board's relative lack of bass frequencies, along with excessive response in the 2,000- to 3,000-Hz range, robs deep male voices of their fullness and gives an overly crisp quality to the diction. That "defect" may occasionally be desirable when a noisy line makes overarticulation necessary. But poor response above 1,000 Hz—as seen in the graphs for the Voicemate 50 and, even

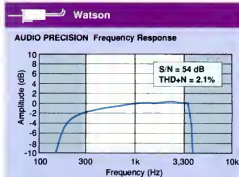
worse, for the IBM Voice Communication Option—has no compensating advantage: It produces a tubby sound on male voices and could make it difficult for some people to distinguish such consonants as p, t, and k.

Imperfect devices also create harmonic distortion effects, recorded on the graphs as the THD+N (total harmonic distortion plus noise). If a pure tone of 400 Hz is recorded, for example, the playback will be found to contain some percentage of newly created tones at 800 Hz, 1,200 Hz, 1,600 Hz, and so on. While the ear is relatively tolerant of distortion when deciphering speech, the lower the distortion the clearer and more natural the voice will sound. Watson and the VBX System displayed the lowest THD+N (2.1 percent); the other units, with figures of 4.6 to 7.1 percent THD+N, were about average and should not be worrisome in voice mail applications.

Practical electronic devices add some measure of noise to the signals they process. We measured the signal-to-noise (S/N) ratios of the various voice-mail systems using a telephone-standard "C-message" weighting filter and a fixed reference level (-10 dBm). The higher the S/N ratio, the less likely that the system will add audible background hiss to an otherwise clear message. The *nitareceptionist* had the best signal-to-noise performance in the group (57 dB), with Watson, VBX, and BigMouth close behind.—Craig L. Stark



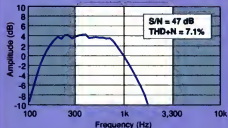
The excessive responsiveness of the BigMouth unit in the 2,000- to 3,000-Hz range and the relative lack of bass frequencies give the voice an overly crisp quality. The S/N ratio of 53 dB and the THD+N of 4.7 percent are within the normal range.



The Watson board shows solid frequency response throughout the 300- to 3,300-Hz range. The board also shows a strong S/N ratio of 54 dB. And the THD+N figure of 2.1 percent indicates the best performance among the units tested.

IBM Voice Communication Option

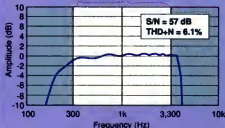
AUDIO PRECISION Frequency Response



The IBM Voice Communication Option is the oldest (and most unenhanced) board tested. It also has the worst-looking frequency response curve. The THD+N, at 7.1 percent, is excessively high, while the S/N ratio is a very low 47 dB. From these results, it isn't surprising that this board has the worst sound quality of the group.

nitaReceptionist

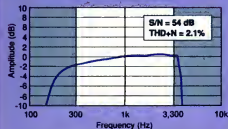
AUDIO PRECISION Frequency Response



Of all the units tested, *nitaReceptionist* produced the best frequency response curve. Note the flat, barely wavering curve throughout the 300- to 3,000-Hz range. At 57 dB, this unit also had the best S/N ratio.

VBX System

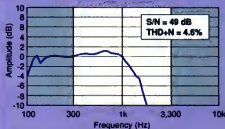
AUDIO PRECISION Frequency Response



The VBX System is simply two Watson boards linked together to form a multiline system. As expected, the results for the VBX System are nearly identical to those for Watson.

Voicemate 50

AUDIO PRECISION Frequency Response



While the Voicemate 50 shows a good, steady frequency response in the 300- to 1,000-Hz range, the curve suddenly falls off sharply. The THD+N figure of 4.6 percent is about average, while the S/N ratio of 49 dB indicates the unit will add some noticeable background hiss to the message.

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Lotus ... NCP	
□ Agenda 1.0	\$289.
□ 1-2-3 2.01 (upgrade free to version 3.0)	call
□ Hal 1.0	109.
□ Freelance Plus 2.0	345.
□ Manuscript 2.0	359.
□ Graphwriter II 1.0	349.
MECA ... NCP	
□ Managing Your Money 5.0	119.
□ Andrew Tobias' Tax Cut 1040	special
Meriden Technology ... NCP	
□ CarbonCopy Plus 5.0	115.
Micro Logic ... NCP	
□ Tornado 1.8	55.
Microlytics ... NCP	
□ Goler 1.0 (text retrieval system)	45.
□ Wordfinder 4.0 (electronic thesaurus)	35.
MicroPro ... NCP	
□ WordStar Professional Release 5	259.
□ WordStar 2000 Plus Rel. 3 (Personal Ed.)	259.
Microsim ... NCP	
□ R-BASE for DOS (version 2.1)	449.
□ R-BASE for OS/2	599.
Microsoft ... NCP	
□ Learning DOS 2.0 (for any DOS version)	35.
□ Windows 286 2.1	69.
□ Windows 286 2.1 w/Mouse	145.
□ Works 1.05	99.
□ Windows 386 2.1	129.
□ Word 4.0	209.
□ Chart 3.0	219.
□ Excel 2.1 (requires 80286/80386 CPU)	359.
□ Word 4.0 Network Version	499.
CD-ROM	
□ Bookshelf 1.0 w/Amdek Laser Drive	799.
□ Programmers Library 1.0	269.
LANGUAGES	
□ Quick BASIC 4.5	69.
□ Quick C 1.01	69.
□ Macro Assembler 5.1	99.
□ Basic Compiler 6.0	199.
□ Pascal 4.0	199.
□ Fortran 4.1	289.
□ C Compiler 5.1	299.
□ Cobol 3.0	599.
Nantuckit Software ... NCP	
□ Clipper (Summer '87, d33 Plus compiler)	429.
New England Software ... NCP	
□ Graph-in-the-Box Release 2	75.
□ GB-Stat 1.0	159.
□ GB Analytic 1.0	105.
Nolo Press ... NCP	
□ WillMaker 3.0	35.
North Edge Software ... NCP	
□ Timeslips III 3.3	119.
Owl International ... NCP	
□ Guide 2.0	143.

PC Connection Software Special through January 31, 1989

MECA ... NCP R. Andrew Tobias' Tax Cut 1040

A powerful partnership has developed to help you through this tax season. Best Programs has teamed up with MECA Ventures to bring you Andrew Tobias' Tax Cut. Some program features of this "early bird version" include:

- Integration with MECA's Managing Your Money to bring you a complete financial system
- Completely up-to-date with current tax laws
- Final calculations are certified by an independent accounting firm before product is shipped to you
- Free upgrade for this "early bird version" directly from MECA

Andrew Tobias' Tax Cut 1040 for 1988
Taxes ... \$49.

Paperback Software ... NCP

□ VPI-Info 1.4	65.
□ VPI-Planner Plus 2.0	145.
□ VPI-Expert 2.0	145.

Paul Mace ... NCP

□ H/Text-H/Format 2.0 (hard-disk tools)	49.
□ Mace Utilities 5.0 (DOS utilities)	55.
□ Grasp 3.1	79.
□ Envelope 1.01	29.

PC Support Group ... NCP

□ Lightning 4.82	57.
□ Lucid 3-D 1.22	89.

Personica ... NCP

□ SmartNotes 2.0	49.
□ SeeMORE 1.0	49.
□ Look&Link 1.01	59.
□ Ultravision 1.0	79.
□ @BASE 1.1	119.

Peter Norton ... NCP

□ Norton Editor 1.21	39.
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□ Norton Commander 2.0	\$45.
□ Advanced Utilities 4.5	79.
□ Dan Bricklin's Demo Program 2	99.
Quarterdeck ... NCP	
□ DESQView 2.2	79.
□ Expanded Memory Manager 4.2	39.
Reference Software ... NCP	
□ Grammarik III 1.05 (electronic proofreader)	52.
□ Reference File 5.03 (pop-up DB manager)	49.
Relay Communications	
□ Relay Gold 3.0	149.
Revolution Software ... NCP	
□ VGA Dimmer (screen saver)	19.
□ DJ (disk manager)	39.
□ Cruise Control 3.02	39.
Rightsoft ... NCP	
□ Rightwriter 3.0	54.
Simon & Schuster ... NCP	
□ Professional Thesaurus 1.0	79.
□ Typing Tutor IV	33.
Softlogic Solutions ... NCP	
□ Software Carousel 2.02	49.
□ Disk Optimizer 4.01 (w/Data Guardian)	45.
□ @Liberty 1.1	119.
□ Cubit 2.02	45.
□ Double Double 4.02	45.
□ Magic Mirror 1.0	59.
SoftView ... NCP	
□ TaxView (for 1988 taxes)	special
Software Group ... NCP	
□ Enable 2.0	399.
Software Publishing ... NCP	
□ Professional Plan 1.01	59.
□ PFS: First Publisher 2.0	79.
□ PFS: First Graphics 1.0	95.
□ PFS: First Choice 3.0	99.
□ Professional Write 2.0	125.
□ Professional File 2.0	189.
□ Office Writer 6.0	259.
□ Harvard Graphics 2.1	309.
□ Harvard Graphics Accessories	call
□ Harvard Project Manager 3.0	439.
Spinmaker ... NCP	
□ Resume Kit 1.0	25.
□ Eight-in-One 1.1	39.
□ Splash 1.0	59.
□ Pinstripe Presenter 1.0	115.
Springboard ... NCP	
□ Newsroom Pro 1.0	45.
□ Certificate Maker	34.
□ Clip Art 1	19.
□ Clip Art 2	25.
□ Clip Art 3	19.
Symantec ... NCP	
□ SO2Plus 1.11	59.
□ Word 2.0	59.
□ Q & A Write 1.01	119.

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Grandview 1.0	\$175.
Q & A 3.0 (database, word processor)	209.
Breakthrough Timeline 3.0	349.
Spreadsheet Analyst 2.5	69.
Note-It Plus 1.02	49.
Think Tank 2.4NP	115.
Views 1.0	69.
Q&A Network Pak 1.0 (requires Q&A)	179.
T/Maker ... NCP	
Scrapbook + 1.0	79.
ClickArt Business Images	42.
ClickArt Holidays	42.
EPS (PostScript) Illustrations	79.
The XTREE Co. ... NCP	
XTREE Pro 1.0	69.
Hot 4.0	95.
TOPS ... NCP	
Flashcard (Apple Talk network card, 1 year warranty)	169.
NetPrint 2.0 (share printers)	119.
TOPS 2.0	119.
TOPS Repeater (extends network)	132.
Traveling Software ... NCP	
Battery Watch 1.0 (3 1/2" only)	27.
Laplink Mac 1.2 (Mac-PC transfer)	79.
Laplink Plus 2.1	85.
Desklink 2.21	99.
True BASIC, Inc. ... NCP	
True BASIC 2.03 (now includes Runtime)	57.
Kernery/Kurt Math Series	32.
True Basic Libraries	32.
Vericomp ... NCP	
SoftBytes 2.0	35.
SoftBytes 386 2.53	49.
WordPerfect Corp. ... NCP	
WordPerfect Library 2.0	69.
WordPerfect 5.0	255.
WordPerfect 5.0 Add'l Network Stations	269.
WordPerfect Office 1.0	269.
WordPerfect Office 1.0 Add'l Network Stations	84.
WordPerfect Network Server 5.0	349.
DataPerfect	129.
Wordtech ... NCP	
DBXL 1.2	119.
Xerox ... NCP	
Ventura Publisher 2.0	549.
XyQuest ... NCP	
XyWrite III Plus 3.54 w/At-A-Carte Menus	239.
RECREATIONAL/EDUCATIONAL	
Accolade ... CP (reqs. graphics brd.)	
Bubble Ghost	22.
Mean 18	29.
Hardball (baseball simulation)	11.

PC Connection Hardware Special through January 31, 1989

Intel ... 5 years
Above Board Plus 512k
Above Board 2 Plus 512k
Above Board Plus I/O 512k

Intel has introduced their new generation of memory expansion products for the PC, XT, AT, and PS/2 Models 25, 30, 50, 50Z and 60. Features include:

- Above Board Plus and Plus I/O hold up to 8 Meg in one slot when used with the 6 Meg piggyback option
- Above Board 2 Plus for PS/2 Models 50, 50Z and 60 can use 256k SIMMs for 8 Meg maximum
- Full UVM EMS 4.0 support in hardware, compatible with Windows 2.x, DESQview, and OS/2
- Switchless installation

Above Board Plus 512k ... \$429.
Above Board 2 Plus 512k ... \$479.
Above Board Plus I/O 512k ... \$529.

Testdrive (driving simulation)	24.
Jack Nicklaus' 18 Greatest Holes	29.
Grand Prix	22.
4th & Inches	22.
Broderbund ... CP	
Where in the World is Carmen San Diego?	25.
Where in the USA is Carmen San Diego?	25.
Where in Europe is Carmen San Diego?	25.
Toy Shop	35.
Ultima IV	35.
Ultima V	39.
Electronic Arts ... CP (reqs. graphics brd.)	
One-on-One/Bird vs Jordan	29.
Chuck Yeager's Flight Simulator	32.
Chessmaster 2000	32.
Earl Weaver Baseball	32.
Empire	35.
Mavis Beacon Teaches Typing	35.
Seminar Worlds	39.
Grand Slam Bridge	45.
Infocom ... NCP	
Zork Trilogy	33.
Lifestyle Publishing Group ... NCP	
Golf Doctor (improve your game)	33.
Golf's Best Pinhurst #2 (play the best)	32.
Golf Statkeeper (includes USGA Handicapper)	27.
19th Hole Special (3 Golf programs above bundled with Mr. Boston Micro Bartender's Guide) ... special	
Mr. Boston Official Micro Bartender's Guide	18.
Micro Video Companion	24.
Take Control of Cholesterol	24.
Microprose ... CP	
F-19 Stealth Fighter (requires CGA or EGA)	39.
F-15 Strike Eagle (requires CGA)	22.
Gunsip (requires CGA or EGA)	32.
Microsoft ... NCP	
Flight Simulator 3.0 (reqs. graphics brd.)	35.
Parlor Software ... CP	
Bridge Parlor (best Bridge simulation)	49.
Siem On-Line ... CP (All require Hercules, CGA or EGA)	
Leisure Suit Larry	25.
Space Quest II	33.
King's Quest IV (512k version)	33.
Manhunter	33.
Police Quest	33.
Police Quest II	33.
Leisure Suit Larry II	33.
Thexder	24.
3D Helicopter	33.
Simon & Schuster	
Star Trek: Rebel Universe	29.
Sphere, Inc. ... NCP	
Orbiter (shuttle simulation)	27.
GATO (submarine simulation)	12.
Tetris (addicting mind teaser)	24.
Falcon (F-16 simulation, reqs. graphics brd.)	32.
Spinmaker ... NCP	
Sargon III (chess game)	15.
Kids on Keys (ages 3 to 9)	19.
Facemaker Gold (ages 3 to 8)	25.
Kindercomp Gold (ages 3 to 8)	25.
SAT Preparation Program	25.
Kidwiter Gold (ages 6 to 10)	32.
Homework Helper—Math (grades 7-12)	32.
Homework Helper—Writing (grades 7-12)	32.
Stone & Assoc. ... NCP (reqs. graph. brd.)	
Algebra Plus (ages 13 to adult)	27.
Memory Master (ages 2 to 6)	27.
My Letters, Numbers, Words (2 to 6)	22.
Second Math (ages 7 to 16)	22.
Sublogic ... NCP	
Jet 2.1 (requires EGA or CGA)	33.
Scenery Disks	each 15.
San Francisco Star Scenery Disk	18.
Japan Scenery Disk	15.
The Learning Company ... CP	
Math Rabbit (ages 4 to 7)	26.
Reader Rabbit (ages 4 to 7)	26.
Winter Rabbit (ages 6 to 12)	26.
XOR ... NCP	
INFL Challenge 2.0	69.

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HARDWARE

Manufacturer's standard limited warranty period for terms shown is listed after each company name. Some products in their line may have different warranty periods.

Alloy ... 1 year	
Tape System/2 (for PS/2 MicroChannel) ...	\$299
Retriever/40 (for IBM AT & compatibles) ...	349.
AST Research ... 2 years	
I/O Mini 2 C/S/P ...	89.
SoPak Plus 64k C/S/P (upgrades to 576k) ...	129
Advantage Premium 512k S/P (upgrades to 1 Meg or 2 Meg w/Piggyback) ...	call
Advantage 2 512k (for PS/2 Models 50/60) ...	call
Advantage 2-386 (for PS/2 Model 80) ...	call
RAMpage Plus 286 512k (for XT/286/AT) ...	call
RAMpage! Plus MicroChannel 512k (for PS/2 Models 50/60) ...	call
Amdex ... 90 days	
LaserDrive-1 (external CD-ROM Drive) ...	629.
LaserDrive-2 (internal CD-ROM Drive) ...	629.
CompuCable ... 2 years	
2-Position switch box ...	29.
3-Position switch box ...	39.
Cuesta ... 1 year	
Datasaver 400 Watt (standby power backup unit) ...	459
Curtis ... lifetime	
ACCESSORIES	
Curtis Clip CC-1 ...	6
Disk Holder DB-1 (holds 50 5 1/4" disks) ...	8
3 1/2" Disk Holder DB-2 (holds up to 40 disks) ...	8
3 1/2" Diskette Cleaning Kit CK-2 ...	16.
Printer Stand PS-1 ...	18
Universal System Stand SS-3 ...	25.
Static Mat SM-2 ...	25.
Toolkit TK-1 ...	25.
DS-1 Switch Box (controls 2 printers) ...	33.
CABLES	
Smartmodem-to-PC Cable EC-7 (9 feet) ...	17.
Printer-to-IBM cable EC-8 (9 feet) ...	17.
PS/2 Keyboard Extension Cable EC-9 ...	25.
Keyboard Extension Cable EC-2 ...	25.
SURGE SUPPRESSORS	
Safestrip SP-3 (6 outlets; 1 year warranty) ...	19.
Filtered Safestrip SPF-3 ...	21.
Diamond SP-1 (6 outlets) ...	29.
Emerald SP-1 ...	36.
Diamond Plus SP-1 Plus ...	41.
Sapphire SPF-1 ...	45.
Ruby SPF-2 (6 outlets; EMI/RFI filtered; 6 ft cord) ...	55.
Ruby-Plus SPF-2 Plus (w/FAX & modem protection) ...	69.

PC Connection Software Special

through January 31, 1989

SoftView ... NCP

8 TaxView for 1988 Taxes

Be prepared to face this tax year head on with SoftView's TaxView. See your tax form right on your PC screen. All calculations will be done automatically for you. And if you have a question, simply consult with the IRS instructions which are right on your screen. Other features include:

- Prints entire form with all data
- Links and updates all forms on each change
- Imports text files from spreadsheets, databases, and accounting programs
- Includes tax planner
- Supports over 75 IRS forms and schedules

TaxView for 1988 Taxes ... \$69.

DOCA ... 1 year

Imra 2 (3270 emulation board) ... 729.

Imra 2 Micro Channel (for PS/2 Models 50/60/70/80) ... 729.

Epson ... 1 year

We are an authorized Epson Service Center.

FX-850 (80 col., 264 cps, 9 pin) ... call

FX-1050 (136 col., 264 cps, 9 pin) ... call

LQ-500 (80 col., 180 cps, 24 pin) ... call

LQ-850 printer (80 col., 264 cps, 24 pin) ... call

LQ-1050 printer (136 col., 264 cps, 24 pin) ... call

LQ-2550 printer (136 col., 400 cps, 24 pin) ... call

LX-800 printer (80 col., 180 cps, 9 pin) ... call

Printer-to-IBM cable (6 feet) ... 15.

Everex ... 1 year

1200 Baud Internal Modem ... 79.

2400 Baud Internal Modem ... 149.

5th Generation ... 1 year

Logical Connection 256k ... 479.

Logical Connection 512k ... 539.

Hayes ... 2 years

Smartmodem 1200 ... 299.

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Smartmodem 1200B (with Smartcom II) ...	\$299.
Smartmodem 1200B (hardware only) ...	265.
Smartmodem 2400 ...	449.
Smartmodem 2400B (with Smartcom II) ...	449.
Hercules ... 2 years	
Graphics Card Plus ...	189.
Network Card Plus (with TDPS DOS) ...	339.
Incolor Card ...	229.
Intel ... 5 years	
2400B Modem (internal modem for IBM-PC/XT/AT) ...	249.
2400B Modem 2 (internal modem for PS/2 Models 50/60/80) ...	269.
Inboard 386/PC w/1 Meg ...	799.
Inboard 386/AT 2K (req. installation kit) ...	899.
Inboard Installation Kit (specify computer) ...	special
Above Board Plus 512k ...	special
Above Board 2 Plus 512k ...	special
Above Board Plus I/O 512k ...	special
Connection Coprocessor (FAX board plus) ...	769.
Optional 2400 Baud Modem for Connection Coprocessor ...	229.
MATH COPROCESSORS	
8087 (for IBM-PC & XT) ...	105.
8087-2 (8 MHz, for PS/2 Models 25 & 30) ...	149.
80287 (for AT & XT/286) ...	165.
80287-8 (for 8 MHz 80286 machines) ...	239.
80287-10 (for PS/2 Models 50 & 60) ...	279.
80387 (for 16 MHz PS/2 Model 80) ...	439.
80387-20 (for 20 MHz PS/2 Model 80) ...	499.
Kensington Microwave ... 1 year	
Masterpiece (with \$15 rebate thru Dec.) ...	94.
Masterpiece Plus (with \$15 rebate thru Dec.) ...	109.
Key Tronic ... 3 years	
101 Keyboard ...	99.
101 Plus Keyboard (enhanced layout) ...	99.
Kraft ... 1 year	
Three-button Joystick ...	33.
High Speed Joystick Adapter Card ...	25.
Adapter Card/3-Button Joystick Bundle ...	49.
KYE International ... lifetime	
Dyna Mouse GM-6 Plus (w/Dr. Halo III) ...	54.
Logitech ... lifetime	
Series 2 Mouse (for PS/2 50/60/70/80) ...	65.
HIREZ Mouse (bus only) ...	89.
Mouse w/Paint Show (bus or serial) ...	95.
Mouse w/LogiCAD (bus or serial) ...	119.
ClearCase Mouse (serial only) ...	99.
ScanMan (hand held scanner) ...	199.
Microsoft ... lifetime	
Mach 20 ...	349.
Disk + Option (for Mach 20) ...	69.
Memory + Option (for Mach 20) ...	339.
Mouse with Paintbrush (bus or serial) ...	109.
Mouse with Easy CAD (bus or serial) ...	125.
Mouse with Windows/286 (bus or serial) ...	145.

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*May 1989 bring you more power,
Better performance, and,
Most importantly, a little peace.*

MSC Technologies ... lifetime

OmniMouse w/Designer Pop-up menus (serial only; 1 year warranty)	\$57.
PC Mouse II w/PC Paint+ (bus or serial)	89.
PC Mouse II w/Ansistech (bus or serial)	105.

NEC ... 2 years

Multisync Plus (960 x 720 max. resolution)	949.
Multisync II (800 x 560 max. resolution)	call

NSI Logic ... 3 years

Smart VGA (supports full VGA specs)	229.
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Orchid Technologies ... 2 years

RAMquest 2-2 (1k/for PS/2 50/50/60)	199.
Tiny Turbo 286 (accelerator board)	289.
ProDesigner VGA	319.
RAMquest Xtra 16/32 (1k/for PS/2 models)	339.

PC Power & Cooling Systems ... 1 year

REPLACEMENT POWER SUPPLIES

Turbo Cool 150 (run 25° - 40° cooler)	129.
Turbo Cool 250 (run 25° - 30° cooler)	169.
Silencer 150 (84% noise reduction)	115.
Silencer 200 (69% noise reduction)	149.

PC Support Group ... 1 year

Breakthrough 286 Accel. Board (8 MHz)	299.
Breakthrough 286 Accel. Board (12 MHz)	449.

Practical Peripherals ... 5 years

1200 Baud Internal Modem (w/ProComm)	89.
1200 Baud External Modem (min)	79.
PILink (parallel line extender/32k)	109.
Microbuffer Inline (par. print buffer/32k)	135.
2400 Baud Internal Modem	151.
2400 Baud External Modem	181.

Princeton Graphics ... 1 year

Ultrasync (supports CGA, EGA, VGA)	549.
Max15 Monochrome Monitor	269.

Safe Power Systems ... 2 years

Safe 250W (standby power backup)	249.
Safe 425W (standby power backup)	359.

Tooshie ... 1 year

P321SL printer (80 col., 216 cps, w/tractor)	529.
P351SX Printer (132 col., 360 cps)	999.
T1000 Laptop (80C86, 6.4 lbs., 5 hr. battery)	call
T1200 Laptop (80C86, 10 MHz, 20 Meg)	call
T1200HB Laptop w/Backlit screen	call
T1200F Laptop Dual Floppy System	call
T1200FB Laptop Dual Floppy System w/Backlit screen	call
T1300/20 Laptop (80286, 8 MHz, 20 Meg)	call
T3200 Laptop (80286, 12 MHz, 40 Meg)	call
T5100 (80386, 16 MHz, 40 Meg)	call
External 5 1/4" Drive for Laptops	369.
768k RAM Card for T1000	299.
1 Meg EMS Card for T1000+/T1200	499.

Video 7 ... 5 years

VEGA Deluxe (supports 640x480)	219.
VEGA VGA (supports full VGA specs)	287.
FastWrite VGA	399.
VRAM VGA	529.

DRIVES

IOmega ... 1 year

Dual 20 Meg Bernoulli Box (8")	\$1679.
20 Meg Cartridge (8")	82.
20 Meg Tripek (8")	244.
Bernoulli II Single 20 Meg Internal (5 1/4")	767.
Bernoulli II Dual 20 Meg External (5 1/4")	1659.
20 Meg cartridge (5 1/4")	59.
20 Meg Tripek (5 1/4")	169.
PC2 Card	169.
PC2B Card (bootable card for PC/XT/AT)	229.
PC4 Card (for PS/2 Model 50/60/70/80)	299.

Mountain Computer ... 1 year

40 Meg Internal Tape Drive (XT, AT or PS/2) 379.	
40 Meg External Tape Drive (XT, AT or PS/2)	479.
40 Meg External Tape Drive w/Power Supply (XT, AT, or PS/2)	569.

Plus Development ... 2 years

Hardcard 20 Meg (49 ms)	549.
Hardcard 40 Meg (28 ms)	699.
Passport (20 or 40 Meg removable drives)	call

Seagate ... 1 year

FREE PCTV® Hard Drive Installation Tape with the purchase of 20, 30 or 40 Meg Seagate drive for the IBM PC (not for AT). Specify Beta or VHS.

20 Meg Internal Hard Drive ST225 (w/controller and cables, 65 ms)	299.
30 Meg Internal Hard Drive ST238 (w/controller and cables, 65 ms)	329.
40 Meg Internal Hard Drive for AT (40 ms)	399.
40 Meg Internal Hard Drive for XT (w/controller and cables, 40 ms)	469.
40 Meg Internal HD ST251-1 for AT (28 ms)	469.
80 Meg Internal HD ST4096 for AT (28 ms)	689.

TEAC ... 1 year

PC, XT, 360K Drive (5 1/4" half-height)	89.
720K Drive (3 1/2" half-height, specify XT or AT)	95.
1.44 Meg Drive for AT (3 1/2" half-height, includes Bastech software utilities)	125.

Tooshie ... 1 year

AT 360K Drive (5 1/4" half-height)	89.
AT 1.2 Meg Drive (5 1/4" half-height)	99.

DISKS

All disks have a lifetime warranty.

5 1/4" DS/DD Disks for PC & XT (360K)	
Fuji MD2D (10 disks per box)	12.
Sony (10 disks per box)	12.
Maxell MD2-D (10 disks per box)	13.
Verbatim Datalite (10 disks per box)	13.

5 1/4" DS/High Density Disks for AT (1.2 Meg)

Fuji MD2HD (10 disks per box)	\$22.
Sony (10 disks per box)	23.
Maxell MD2-HD (10 disks per box)	23.
Verbatim Datalite (10 disks per box)	22.
3 1/2" DS/DD Diskettes (720K)	
Sony (10 disks per box)	19.
Fuji (10 disks per box)	19.
Maxell (10 disks per box)	20.
3 1/2" DS/High-Density Diskettes (1.44 Meg)	
Sony (10 disks per box)	55.
Fuji (10 disks per box)	55.
Maxell (10 disks per box)	59.

MISCELLANEOUS

CompuServe

Compuserve Information Service	24.
Grolier's OnLine Encyclopedia	19.
Cables ... lifetime	
Smartmodem-to-AT cable (9 feet)	15.
Parallel Printer cable (15 feet)	19.

OUR POLICY

- We accept VISA and MASTERCARD only.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
- No sales tax.
- All U.S. shipments insured, no additional charge.
- APO/FPO orders shipped 1st Class Mail, charged by weight.
- Allow 1 week for personal and company checks to clear.
- COD max. \$1000. Cash, cashier's check, or money order.
- 120 day limited warranty on all products.*
- To order, call us Monday through Friday 9:00 to 9:00, or Saturday 9:00 to 5:30. You can call our business offices at 603/446-3383 Monday through Friday 9:00 to 5:30.

SHIPPING

Note: Accounts on net terms pay actual shipping. **Continental US:**

- For monitors, printers, Bernoulli Boxes, computers, and hard drives, pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add \$3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.
- Hawaii:**
- For monitors, printers, Bernoulli Boxes, and computers, actual UPS Blue charge will be added. For all other items, add \$3 per order.
- Alaska and outside Continental US:**
- Call 603/446-3383 for information.

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ILLUSTRATION BY MICHAEL K. BROWN

■ VOICE MAIL SYSTEMS

Receptionist Data Table				
User Name	Extension Number	User Code	Sec. Mgt. Code	Type
Operator	11	00000000	9200	1
M. David Stone	16	00000016	7622	1
Heidi Pine	17 N205 19146666666	00000017	3793	1
Ronald Reagan	12	00000120	3972	1
Frank Mitard	19	00000190	6710	1
Directory		00000411		0

Tab/Enter next Shift-Tab previous Del del line Home first End last Esc exit

The *nita* Receptionist screens are simple but often obscure. On the table of mailbox owners on the screen shown here, the entries for user name and extension number are reasonably obvious. However, User Code could be called mailbox number, and Sec. Code might better be called password. The additional entry after extension 17 includes a notification code, N205, telling *nita* to call the mailbox owner at another number, 19146666666, to notify her of incoming messages. Mgt. Type identifies the kind of mailbox.

an outside line, the phone signals will often be different. In PC Labs tests, *nita* reliably gave the notification message to the ringback signal. According to ITI, it is possible to configure *nita* so that it will work with outside lines, but this is not easy and is not guaranteed to work in all cases.

OPTIMAL MAILBOX INTERFACE

For the mailbox owner, *nita* is far easier to learn and use. To use your mailbox, you call the system, enter your security code, and follow the prompts for retrieving messages, changing your greeting, or adjusting the handling options.

Handling options include normal handling (which rings your phone, taking a message if there is no answer), holding calls (which takes a message without ringing your phone), or screening calls (which prompts for the caller's name and then plays the person's name for you, letting you decide whether to take the call or refuse it). If you have more than one mailbox, you can set a different handling option for each, so calls to one mailbox can be held while calls to another are sent through.

nita is notable for its high voice quality. In addition, the prompts are easy to follow and easy to change. While new mailbox owners will want to listen to complete prompts, those who are familiar with the system can enter commands at will and skip the prompts.

Callers to *nita* will also find the system easy to navigate. Here again, the prompts are clear, and the system allows more knowledgeable users to skip most of them by pressing the appropriate tones.

To its designers' credit, *nita* is set up so that if it hears nothing in response to the system greeting message, it will send the call to the human operator. And it will let a caller dial the operator at any time.

DIRECTORY ASSISTANCE Another notable feature is the directory mailbox, which is a directory of people on your system. Callers can then dial the number for directory assistance—411, for example—and hear a list of names and extensions. If you have a large system, you can create more than one directory mailbox, allowing you to split a large directory into manageable portions. You can also use the

feature as an informational bulletin board.

As you might expect, given *nita*'s weakness in calling outside lines, there are no outbound timed message or telemarketing features. Nor are there any in-house voice mail features, such as forwarding messages to other mailboxes, or distribution lists for sending messages to multiple mailboxes. (According to ITI all these features will be available in the next version.)

ITI sells an optional module that lets callers find a mailbox by selecting tones to spell out a name. Another optional package will let you program your own application that uses a tone phone as a remote terminal to a voice database.

Many ITI VARs have developed their own enhancements, including inbound and outbound telemarketing and even the ability to take calls—as with Dial-a-Joke—and have your local phone company bill the callers. ITI maintains a complete list of VAR-produced enhancements.

By any measure, the basic *nita* Receptionist offers a full-scale auto-attendant and message center system that is hard to beat. Given the options available at this writing and the enhancements promised in the next release, there are few applications that *nita* will not be able to handle.



NATURAL MICROSYSTEMS VBX System

The VBX System uses two boards—one for each line. The boards look identical to Watson boards, but according to Natural Microsystems, they have a different PROM. The software is immediately recognizable to anyone who has used a single-line Watson. In fact, it consists of two Watson modules running concurrently and sharing the same card files. One module runs in background, the other in foreground. In addition, there is an administrator module for managing mailboxes, system settings, and other features.

The administrator module is a superset of the *Business Central* administrator; for functions that it shares, it works exactly the

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- Allows for multi company ledgers.
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- Alerts user to customer exceeding credit limit.
- Sales history reports.
- Automatic updating of inventory daily.
- Allows return credit memos.

ACCOUNTS PAYABLE

- Can post to 200 general ledger expense accounts per invoice.
- Prints checks.
- Automatically prepares payments.
- Supports partial and handwritten checks.
- Processes credit and debit memos.
- Computes discounts and records discounts taken.

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- Generates automatic payroll.
- Provides up to 8 user-defined rates.
- Allows point factor payroll.
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CIRCLE 194 ON READER SERVICE CARD

■ VOICE MAIL SYSTEMS

WATSON VBX (tm) ADMINISTRATOR 1.20 (c) Copyright 1987 Natural Microsystems
Modify a member.

Enter member name (Last, First): Stone, David
Phone number (extension): 21
Enter member ID: 21
Voice Mail password: 21
Screen calls for this member? Yes No
Memo information: Yes No
Recorded Message: Play Record Skip
Individual forwarding message: Record Skip

Stone, David 21
1 21 pass: 21

The VBX System Administrator shown here, and the nearly identical Watson Business Central Administrator, lets the system administrator ignore Watson's cord-file system (see Watson's screen shot) and use menus instead. This screen is easy to follow, with a clean design and self-explanatory choices. While the system administrator fills in the menu choices, the administrator program fills in the cord shown mid-screen and passes the information on to the VBX System.

same way. VBX also adds outbound telemarketing, an informational bulletin board, and inbound telemarketing. As with other VBX features, these are designed with an emphasis on ease of use.

Almost everything else about VBX exactly matches *Business Central*. The manuals are virtually identical, as are prompts, voice menus, and other details. In fact, the two packages are too similar—right down to the problem with call screening.

It's hard to accept that the \$3,995 VBX should reasonably cost more than five times as much as Watson with *Business Central*. For the same price, you could buy two complete Watson with *Business Central* packages plus a computer for the second Watson, and still have money left over. Of course, two Watson Business Centrals would not share mailboxes and would not include telemarketing or bulletin board features, but that doesn't seem to be enough to explain the difference in price.

Interestingly, VBX is among the least expensive of two-line systems. Compared with its direct competition, it offers fair

PC FACT FILE

VBX System, Version 1.20

Natural Microsystems

8 Erie Dr.

Natick, MA 01760

(617) 655-0700

List Price: \$3,995

Requires: 512K RAM, hard disk, two full-length slots, DOS 2.0 or later.

Phone Requirements: Two analog lines, two local phones. PBX transfer needs switch hook.

In Short: This two-line version of Watson is easy to learn and use. It offers multitier, multi-mailbox capability, an auto-attendant, an informational bulletin board, and inbound and outbound telemarketing features. VBX is the least expensive multiline system with a predefined auto-attendant.

CIRCLE 867 ON READER SERVICE CARD

value. However, given the comparison to a Watson with *Business Central* package—a voice mail market that is showing signs of life—and the likelihood of in-

creased competition, it's hard to recommend VBX at this price. If you need a two-line, auto-attendant system now, VBX will do. If you can afford to wait, your patience may well pay off.



AMERICAN TELESYSTEMS CORP.

Voicemail 25 Voicemail 50

Designed to provide in-house voice mail functions for a small to medium-sized business or department, American Telesystems' Voicemail comes in two flavors. The plain vanilla Voicemail offers full-fledged in-house voice mail functions but minimal answering-machine functions. It can be souped up with a call processing option that adds auto-attendant features for better handling of outside callers. (The Voicemail 26 model is discussed at the end of this review.) Neither version offers such frills as individual greeting messages or outbound dialing, but both are rock-solid in-house systems.

Voicemail comes in two models. The \$3,995 Voicemail 25 can answer two phone lines, and the \$5,995 Voicemail 50 can answer three. The model numbers reflect the recommended number of mailboxes for each model, though the Model 25 lets you define 40 mailboxes and the Model 50 lets you define 75. The call-processing option can be used with either model.

According to American Telesystems, the Models 25 and 50 differ only in firmware and software support for the extra line. (Upgrades involve swapping both hardware and software. American Telesystems will let you upgrade for the difference in price within 1 year of buying the Voicemail 25.) Although we tested only the Model 25 for this review, all comments should apply to both models, except where stated otherwise.

The Voicemail requires a dedicated PC. Although the system can answer more than one line at a time and continues work-

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CIRCLE 174 ON READER SERVICE CARD

■ VOICE MAIL SYSTEMS

ing while the system administrator makes changes to the configuration or mailboxes, it will not run in background while you run other applications.

Oddly, the Model 25 is designed for a maximum (and recommended) 20MB hard disk; the Model 50 is designed for 30MB. With either model, if you have a larger disk than recommended, the extra space is ignored.

You won't find an entry for file size for Voicemail on the PC Labs performance tests because Voicemail uses its own operating system. There is no way to determine the size of individual files. According to American Telesystems, a 20MB disk translates to a maximum of 1½ hours of recording time. If you assume an average message length of 30 seconds, that translates to 180 messages—probably enough for the recommended 25 mailboxes but tight for the absolute maximum of 40. (A 30MB disk gives 2½ hours.)

EASY INSTALLATION To install the Voicemail hardware, you plug the board into the computer and plug a phone cable

VOICEMAIL CONFIGURATION

2	Time Limit for Recording Messages (minutes)
30	Message Retention Time (days)
45	Inactivity Timeout (seconds)
1	Number of Rings before Answering
2	Digits in Extension Numbers
11	Attendant's Extension Number
Name	Reference by Name / Extension Number

• Call-Handling Procedures •

	----- DAY mode -----	----- NIGHT mode -----
Line 1:	Extended Access	Extended Access
Line 2:	Extended Access	Extended Access

• Times and Days for DAY mode to be active •

Beginning Time: 8:00 a.m.	Sun Mon Tue Wed Thu Fri Sat
Ending Time: 5:00 p.m.	NO YES YES YES YES YES NO

Press <F1> when finished making changes or press <Esc> to leave unchanged.

Voicemail offers relatively few options for the system administrator to set. Voicemail is unusual in giving the system administrator the ability to force automatic erasure of old messages by choosing the Message Retention Time (Days) option.

into a two-line, RJ-14 phone connector. For the Model 50 you would also plug in a second cable with one additional line.

Software installation is equally easy. The installation program warns you that it's about to wipe out your hard disk. After you give it permission, it formats your disk, prompts you for several disk swaps with your DOS disk, then initializes the Voicemail partition—a time-consuming procedure. Finally, it prompts you to insert each of the seven vocabulary disks, copying each to your hard disk.

Creating the mailboxes and setting the configuration options takes less time than initializing the hard disk. Not only are the function-key menus easy to learn and use, but also each option is fully explained in the system administrator guide. For example, you can select Update User Accounts from the main menu to create, modify, or delete mailboxes. Modify System Configuration lets you set such options as the time limit for recording, number of days for message retention, and whether to let callers without mailboxes leave messages.

One other main menu choice worth mentioning is Update Distribution Lists. Any mailbox owner can use distribution lists, but the system administrator is the only one who can create them. The Model

25 allows up to five lists of ten names each, and the Model 50 allows up to ten lists of ten names. In addition, a systemwide list is created automatically.

Although Voicemail doesn't allow individual greeting messages, the system administrator can record each mailbox owner's name. When callers ask for a given mailbox, Voicemail will then read back the name for confirmation.

Alas, from the mailbox owner's perspective, using Voicemail is not as easy as setting up the system. In fact, the manual recommends formal classroom training for all mailbox owners. Take this recommendation seriously.

HARD TO CALL IN When you call Voicemail, the system gives instructions to "press the star key followed by the last name and first name of the person you wish to call until recognized." In theory, this is a convenient feature, since you have to press only enough telephone-produced tones to differentiate between people on the system. Unfortunately, outside callers are likely to be confused, since few people correctly interpret this instruction the first time. Many will enter the first name instead of the last name; some will become intimidated and hang up.



FACT FILE

Voicemail 25

Voicemail 50

American Telesystems Corp.
Seven Piedmont Ctr., #200
Atlanta, GA 30305
(404) 266-2500

List Price: \$3,995 (Model 25), \$5,995 (Model 50), \$995 (Call Processing Option).

Requires: 512K RAM (640K recommended); 20MB hard disk strongly recommended (gives 1½ message hours). DOS 2.0 or later. Voicemail 50 uses a 20 or 30MB hard disk; 30MB is recommended (gives 2½ message hours). Neither model can use more.

Phone Requirements: Model 25, two analog lines; Model 50, three analog lines. PBX transfer needs switch hook.

In Short: Voicemail is strong on in-house voice mail features, weak on answering machine functionality. The standard version makes it easy for mailbox owners to communicate with one another, but it will hang up on outside callers who don't give it the right commands. An optional auto-attendant tames Voicemail somewhat, making it more appropriate for use as a multimailbox answering system.

CIRCLE 661 ON READER SERVICE CARD



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CIRCLE 144 ON READER SERVICE CARD

■ VOICE MAIL SYSTEMS

Particularly disturbing is the fact that Voicemail hangs up the phone if you do not enter the information properly. There is no general collection area for messages and no way for someone on a pulse phone to leave a message. Though this is acceptable if you plan to plug the system into its own extension on your PBX and use it solely for in-house voice mail, it is questionable if you plan to use Voicemail to answer phones. (The optional call-processing module available with Voicemail Model 26 helps solve these problems.)

Once you are familiar with the system, you can easily get your own messages, leave messages in other people's mailboxes, and change your password in a single call. You can also send a given message to several people either by using

choices instead of explaining each.

If you are looking for an in-house voice mail system, the standard version of Voicemail is a good place to start. But don't expect it to be the solution for answering outside calls.

VOICEMATE 26 If you like Voicemail's focus on in-house voice mail features but also need multiuser answering-machine capabilities, you'll want to look at the Voicemail Model 26. It has all the features of the Model 25 but includes auto-attendant features.

The auto-attendant option adds two call-handling choices: auto-attendant and call backup. A handy feature allows each line to be set independently so that one line can behave like the Model 25 while another line takes advantage of the extra features.

Unfortunately, the auto-attendant takes a minimalist approach. Call the line that is set to auto-attendant, and Voicemail will prompt you to dial an extension or go to a human receptionist. It then transfers the call and hangs up. If there is no answer, most PBXs will send you back to the Voicemail extension, where you will hear the system greeting message again.

Callers who know enough to press the star key can get to in-house voice mail from the greeting message, but there is no prompt for that—and no way to include such a prompt. Most callers will be stuck in an infinite loop, with no way out but to hang up.

The call backup option offers the feature missing from the auto-attendant. Call a line set for call backup, and you will get the message "The person you called is not available; press 0 to speak to the attendant, press 1 to leave a voice message, press 2 to ring another person." No response automatically sends you to the human receptionist. This is not an appropriate system greeting message.

However, if your phone-switching equipment allows, you can solve these problems by using the auto-attendant and call backup features in tandem. If you set your PBX so that incoming calls will go to the auto-attendant line and all unanswered calls go to the call backup line, you have a close functional equivalent of a full-fledged auto-attendant that can retrieve a

call and then send it to a mailbox. However, this approach ties up two lines where one should do. And the solution won't work if your PBX is unable to redirect unanswered calls.

All told, Voicemail is best suited to in-house voice mail, even with the auto-attendant option. However, if you are primarily interested in in-house voice mail and want answering machine functionality in addition, Voicemail with auto-attendant may be an acceptable solution.



NATURAL MICROSYSTEMS

Watson

Depending on your point of view, Watson is either the Clark Kent and Superman of voice mail systems, or the Dr. Jekyll and Mr. Hyde. The basic Watson package, at \$199, works with a single phone line, providing single-mailbox or minimal multi-



FACT FILE

Watson, Version 6.2
Business Central template Version 1.0

Natural Microsystems

8 Erie Dr.

Natick, MA 01760

(617) 655-0700

List Price: With 1,200-bps modem, \$199; with 2,400-bps modem, \$299; with 1,200-bps modem and VES option, \$399; with 2,400-bps modem and VES option, \$499; VES upgrade, \$299. **Business Central** template, \$199.

Requires: 256K RAM, hard disk recommended; DOS 2.0 or later.

Phone Requirements: One analog line, local phone. PBX transfer needs switch hook.

In Short: Watson is a single-line system with multiple personalities. Watson itself is limited and confusing to learn. VES is a programming language that lets you build almost anything you want into the program. **Business Central** is a VES program that adds auto-attendant features and makes it far easier to maintain mailboxes. If you get Watson, you'll probably want **Business Central**.

CIRCLE 666 ON READER SERVICE CARD

■ If you are looking for an in-house voice mail system, Voicemail is a good place to start. But don't expect it to be the solution for answering outside calls.

distribution lists or by specifying any number of recipient names. A nice touch is that context-sensitive help is available at any point by pressing the pound sign. Unfortunately, you cannot forward your messages to another number when you are out of the office, and you can't send messages to anyone who doesn't have a mailbox.

Voice quality for both prompts and recorded messages is acceptable, though slightly hollow. While the prompts are straightforward (for example, you are told to press T to talk or G to get messages), you cannot change the prompts. Once a mailbox owner is familiar with the commands, the system administrator can set his or her mailbox for a shortened version, which speeds up sessions by simply listing

■ VOICE MAIL SYSTEMS

mailbox functions. Add the *Voice Information System (VIS)* option for another \$199, and Clark Kent turns to Superman, with a programming language that will let you add any answering-machine feature.

Alas, the potential of VIS is available only to those who are willing to learn a new programming language. If you plan to install Watson for clients, this may be worth the investment. But if all you want is your own voice mail system, it's a little like learning dBASE to create one mailing list, then never using it again.

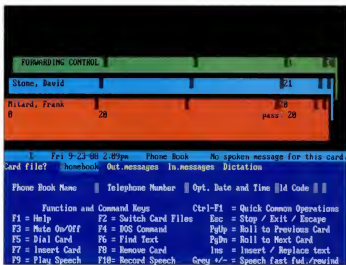
If Watson and VIS seem too forbidding, Natural Microsystems will happily sell you its \$199 *Business Central*, turning Mr. Hyde into Dr. Jekyll. *Business Central* is a VIS program that adds an auto-attendant and, more important, shields you from the underlying program by providing a menu system for managing Watson. Finally (and we've run out of personality-transforming analogies), Natural Microsystems offers a two-line system called VBX (also reviewed in this issue).

VOICE CARD FILES To fully appreciate *Business Central*, you have to understand how Watson works. The program is modeled on a card-file system. Voice-mail "cards" are divided into three different files: incoming messages, outgoing messages, and phone book.

The outgoing message cards store system greeting messages and personal messages, as well as outgoing timed messages. The phone book cards store the names and passwords of mailbox owners, numbers for message forwarding, announcements for message forwarding, and names and numbers for auto-dialing voice calls.

Watson muddies the waters by referring to timed messages as outgoing forwarded messages. These, of course, are different from forwarded messages, which are incoming messages that are forwarded based on information stored in phone book cards. (If you're confused by this, you've gotten the point.)

The manuals offer little help. Although well written, they are poorly organized, for they don't present information in the order in which you need it. It's even difficult to find out what information the manuals contain. For example, the manual labeled *Installation Guide* begins with a



This is Watson's phone book card-file system. Two cards show the names and ID code of mailbox owners on the system, while a third controls the message forwarding feature. The Phone Book card is in the foreground. The command has just been given to switch card files, and Watson is asking which file to switch to. The choice for the dictation card file is available only to the system administrator on multimailbox systems. The function key menu in the bottom quarter of the screen is set off by default, but can be brought up by hitting F1.

table-of-contents page that says nothing about installation. It turns out that the book is several manuals in one and is set up backward: Instructions on using Watson come first, followed by a tutorial. Then come the installation instructions. Sadly, there is nothing in the manual's table of contents to indicate this.

Installation itself is simple. Plug the board into your computer, plug a phone and phone line into the board, and (optionally) add a battery-powered speaker (available at Radio Shack). An install routine copies the program to your hard disk.

Running Watson through the PC Labs performance tests proved two things: though the package can do most of what you may ask of it, you can't learn how to use Watson without reading the manual. Few features are obvious from looking at the screen. Even contacts at Natural Microsystems told me that Watson could not do things I later discovered it could do.

When calling Watson as a mailbox owner, you can listen to incoming mes-

sages, change your greeting message, change your password, create personal messages, create outgoing timed messages, change your message-forwarding announcement, or change your message-forwarding information.

Watson gets points for excellent voice quality. Even better, it gives you a choice of quality. Watson has five levels of data compression; you can designate any two of these as low and high and then set each card file for low or high compression.

All prompts are given in a pleasant female voice. These prompts are spoken faster than in most other packages and cannot be replaced with the package as shipped. (A utility for replacing prompts on an all-or-nothing basis is available from Natural Microsystems on request.) For experienced mailbox owners, the speed should be a boon, but new users may stumble until they learn the system.

A more troublesome problem is that the logic of the voice menus is not obvious. For example, to record a new greeting

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■ VOICE MAIL SYSTEMS

PC EDITOR'S CHOICE

- **BigMouth**
- **nitaReceptionist**

Picking the editor's choice for voice mail systems is difficult: except for IBM's entry, you pretty well get what you pay for.

Among single-line systems, top honors go to BigMouth for its combination of low price and ease of customizability. The Complete Answering Machine gets honorable mention for ease of use within the package's limits.

Multiple-line systems make for a harder choice, since they span a greater range of price and performance. nitaReceptionist is the clear winner for large applications because of its 16-line capacity and high voice quality. Honorable mention goes to VBX, which offers the least expensive multiline system including an auto-attendant. While its two-board approach is inelegant, its mailbox structure is easy to learn and maintain.

message, you have to choose Switch Files, then Outgoing Messages, then Record Speech. Next, you must enter a specific tone to designate this as a greeting message; then, you can record the message. Callers to the system will find Watson easier to use since it has fewer options.

SUPERMAN VS. DR. JEKYLL As already mentioned, V/S will let you add features to Watson through programming. The V/S option costs \$199 if bought with the Watson board, or \$299 as an upgrade. You can use it to create your own template for Watson, or to run a template provided by Natural Microsystems for \$199.

For this review, the company provided the *Business Central* template. *Business Central* adds a manual of its own and a module called the Administrator. The manual is well written and well organized, but almost superfluous, thanks to the Ad-

ministrator. Using the Administrator is so much an improvement on the underlying Watson that you might as well be using a different program. Everything is entered through self-explanatory menus; you need never think about card files at all.

With the Administrator, the system administrator can add or modify mailboxes, set system parameters, record a greeting message or a good-bye message, define settings for the auto-attendant, and enable or disable such features as call screening, message forwarding, and a mailbox directory for callers. The program automatically fills in the appropriate Watson cards.

Calling *Business Central* as a mailbox owner or outside caller is much the same as calling Watson. The auto-attendant adds a few prompts, letting callers dial an extension, listen to a directory of mailboxes, or dial a human receptionist. Mailbox owners cannot send timed messages or control their own passwords, but they can select call screening.

Unfortunately, there is a problem in the screening feature: if screening is set on and the mailbox owner rejects the call, *Business Central* will hang up rather than take a message. Natural Microsystems expects to ship a fixed version shortly.

Even with the screening feature problem, Watson with *Business Central* is far better than Watson without. Based only on ease of use, Watson with *Business Central* is a better value. And if you need the auto-attendant, it is far less expensive than buying Watson with V/S and programming it yourself. As of this writing, two other templates are available—one for medical offices and one for automobile dealerships.

Watson with *Business Central* is the least expensive package reviewed here with predefined auto-attendant features. BigMouth costs less, but defining an auto-attendant with BigMouth takes time. Other packages with predefined auto-attendants start at about \$4,000.

Watson by itself may be acceptable to those on tight budgets. Watson with V/S may be acceptable to programmers and those who can afford them. Watson with *Business Central* is the version for the rest of us. [E]

M. David Stone is a contributing editor of PC Magazine.

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CIRCLE 173 ON READER SERVICE CARD

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onto a single cartridge
smaller than an audiocassette.*

■ One of the main reasons for using a LAN is to give many people access to the same data files simultaneously. But in order to have this capability, all of those valuable information files must be gathered into one place. Putting all of your eggs in one basket has always been a bad practice—unless the basket has a safety net.

And keeping unprotected files becomes more dangerous each year. As computers become more powerful, hard disks increase in capacity, software becomes more useful, and memory require-

FRANK J. DERFLER, JR., AND C. G. MILLIGAN

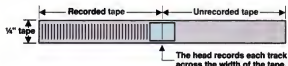
HELICAL-SCAN TECHNOLOGY: THE BASIS OF EXABYTE'S 2-GIGABYTE TAPE-BACKUP DRIVE

Helical-scan technology is one of the reasons that the Exabyte EXB-8200 drive—found inside the LAN server backup devices reviewed in this article—is thought to be the smallest and fastest high-capacity tape-backup drive available. Introduced in January 1987, this system is the first capable of highly reliable unattended backup for high-capacity LAN servers. It is believed to be the only one of its kind currently available in a LAN server backup system priced under \$10,000.

Fitted with a recording mechanism very similar to that used in camcorders, the EXB-8200 drive may prove as revolutionary in the high-capacity data storage market as the camcorder was in the video market. It is capable of saving 2 gigabytes of data onto a data cartridge smaller than a pack of cigarettes in about 2 hours. This is done on a machine that fits into an internal 5¼-inch full-height drive bay, using a medium that costs \$.007 per megabyte. It's done with a data reliability factor one to two orders of magnitude greater than that of conventional longitudinal recording techniques.

HOW THEY WORK Both longitudinal and helical-scan recording technologies rely on magnetism to record data.

Conventional Longitudinal Recording



Conventional longitudinal recording records a track of data straight across the width of a single-track tape, wasting much of the tape.

The basic differences between them are the pattern in which data is recorded and the positioning of the heads used to read, write, and erase the data. Because of the way it stores data, a helical-scan-based machine is able to pack far more data onto the tape it uses.

In machines based on longitudinal technology, the heads are located in the tape path. Tape moves past fixed heads, and data is recorded, read, or erased in a straight up-and-down path that is limited in size to the width of the tape (see the diagram "Conventional Longitudinal Recording").

A helical-scan recorder's heads are mounted on a drum, rotating at 1,800

rpm, around which the tape wraps. Because the tape is positioned at a 5-degree angle in relation to the rotating heads, the narrow track written on the tape can be many times longer than the tape width (see the diagram "Helical-Scan Recording"). Exabyte's EXB-8200 drives write narrow tracks 3.037 inches in length.

The tape used is of higher quality than that used in longitudinal products: it is denser and more highly retentive, and its coercivity rating is far higher than that of longitudinal media (1,450 Oe, as compared to 350 to 450 Oe). Surprisingly, the tape in a helical-scan recorder moves far slower than in a longitudinal one. While tape speeds of 50, 60, and 90 inch-

ments inevitably grow. Think of all the new applications in computer-aided design and manufacturing, computer-generated automation, digital image capturing, and all the recent improvements in often-used programs like those for accounting and database management. Hard disks as large as 600MB are finding ready markets. And as we all know, hard disks can and do crash from time to time.

So how do you protect the ever-growing amount of data that you're collecting? One popular and practical way is to back up the server's hard disk to a hard disk

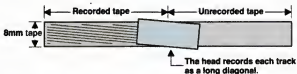
drive on a network workstation. This kind of backup protects against mechanical failures, but it leaves data vulnerable to physical damage that can result from fire or vandalism. Removable hard disk drives are available, but they're limited in storage capacity and are not economical or convenient in many installations.

But there's a better way: now it is possible, in one operation, to back up a group of six 300MB hard disks onto a single tape cassette smaller than an audiocassette. Magnetic tape has always been the backup media of choice for many LAN managers:

tape backup systems typically have good speed, low cost, and great portability. But until recently, 150MB was the most data could save on a compact tape drive.

HELICAL-SCAN RECORDING The technology that has vastly increased the capacity of compact tape drives is called *helical-scan recording* (for a description, see the sidebar "Helical-Scan Technology: The Basis of Exabyte's 2-Gigabyte Tape-Backup Drive"). Originally invented for use in broadcast systems, helical-scan recording has been used in data stor-

Helical-Scan Recording



Helical-scan recording packs more data on the tape by positioning the tape at a 5-degree angle to the recording heads. Each data track is a 3-inch-long diagonal.

es per second are common in a longitudinal recorder, the tape speed is only 0.43 ips in a helical-scan system. Due to the rotation of the heads, however, head-to-tape contact speed is about 148.4 ips.

CHECKING FOR ERRORS Each track the EXB-8200 writes is organized into eight fixed-length data blocks, which collectively can hold a maximum of 8,192 bytes of formatted user data. Each data block consists of 14 bytes of header information, 2 bytes of cyclic redundancy check (CRC), 400 bytes of error-correcting code (ECC), and 1,024 bytes of user data. The ECC bytes in each data block can correct an erroneous data

burst of 256 bytes and an additional 80 random errors.

This method of error checking is very effective for the type of error patterns characteristic of the 8mm cartridge tape that helical-scan technology uses. The reported bit error rate (BER) for writing data is a small $10E-15$, with 12 retry attempts before the error is considered to be a permanent write error. The BER for reading data is reported at $10E-13$, with 8 retry attempts before the read error is marked permanent.

With all these advantages, helical-scan recorders are bound to become the tape-backup systems of choice.—**Kellyn Betts and Frank J. Derfler, Jr.**

age systems for over a decade. Recent refinements in the technology have drastically reduced the cost of drives using helical-scan recording, improved their reliability and performance, and increased their capacity. Using systems incorporating these drives, you can back up multiple drives from multiple servers on a network onto a single tape in minutes, and then put the tape in a shirt pocket to carry it to safe storage.

The tape drive used in the two high-capacity tape storage systems we evaluated for LAN backup duties is the Exabyte

EXB-8200 videotape drive. It is an excellent drive, with a reported mean time between failure (MTBF) of 20,000 hours. Besides using a slower tape-transport speed, the EXB-8200 has a 256K buffer that reduces the incidence of the familiar start-and-stop action associated with the smaller 1/4-inch (6.35mm) cartridge streaming-tape systems. These two enhancements add up to longer tape life and reliability.

The 3- by 23/4- by 1/2-inch 8mm tape cassettes used in the Exabyte EXB-8200 drives of the backup systems we tested can

hold up to 2 gigabytes—that's 2,044 megabytes—of data. Sold under about 20 different labels (including such familiar names as Sony, Maxell, TDK, and BASF, as well as Exabyte), the compact cassettes are also used in many portable camcorders (remember their broadcast system origins; don't confuse them with the much larger VHS or Beta format tapes). They can be purchased at department stores, where their lengths are stated in video recording hours: a 120-minute tape yields approximately 2,044MB of data storage; a 90-minute tape, 1,536MB; a 60-minute tape, 1,024MB; a 30-minute tape, 512MB; and a 15-minute tape, 256MB. (The slightly longer European videotape cartridges can also be used, but you have to change a hardware switch setting for tapes longer than the 120-minute length.)

The compact size and large capacity of the 8mm tape systems reduces the size of the average tape library by 65 percent compared with the 1/4-inch cartridge format. This reduction in volume is even greater when you compare the cassette with 1/2-inch tape reels.

LAN LOCATION DOS is still the operating system of choice for many tape backup manufacturers, and both of the systems we tested are designed to run under DOS. If you use IBM's *PC LAN* or one of the other DOS-based LAN operating systems, then you can attach your backup unit to the server and enjoy the highest possible data transfer rate. Unfortunately, some popular LAN operating systems, like Novell's *NetWare* and Banyan's *VINES*, do not use DOS on the server. (The later versions of *NetWare*, however, are designed to make it easier for manufacturers to integrate tape backup units into the server.)

If you use these backup devices on a LAN with a non-DOS server, then you must attach them to a DOS workstation and draw data from the server through the LAN. This approach significantly increases the time needed for a backup because the transfer rate through the LAN is much slower than the direct transfer rate under DOS. Because it requires a great deal of translation between DOS and non-DOS file systems, it can also produce strange results. For this reason, we checked both tape-backup products for

■ 2-GIGABYTE LAN BACKUP

compatibility with *NerWare*. (*VINES* servers typically contain their own internal streaming-tape-backup mechanism.)

SPEED The effective data-transfer rate during backup and restoration depends on many factors. The factors you control are the speed and efficiency of your network station, the server's disk drive, the disk tree structure, and the network interface card. The factors the tape system controls include the quality of the code in the backup software, the SCSI adapter, and the EXB-8200 buffer-control hardware.

A Western Digital SCSI (Small Computer System Interface) adapter is reported to have a maximum burst data-transfer rate of 1.5MB per second, while the maximum

■ Both tape systems perform backups by copying the disk file by file. This method enables you to restore single files or groups of files to any media.

burst transfer rate with an Adaptec SCSI adapter is expected to be in the 1.2MB-per-second range. In actual operation, however, throughput is often below these maximum values—limited by the ability of the hard disk drive and controller in the server to handle data, and the ability of the network to carry the data.

In this issue we look at the high-capacity 2GB tape-backup systems marketed by Performance Technology Development and Emerald Systems. Both systems perform backups by copying the disk file by file. While this type of backup takes much longer than image backup—the other popular method of tape backup—it enables you to restore single files or groups of files to any media. With an image backup you must restore the entire image to a disk identical to the original. And the speed of



Benchmark Tests: Helical-Scan Tape-Backup Systems

The data transfer rates for the two systems we tested were markedly different, with the *POWERstreamer IV* roughly twice as fast as The *VAST Device* on all tests. The performance differences are attributable to differences in both the SCSI controllers and the controlling software each system uses.

Although both units integrate Exabyte EXB-8200 tape drive subsystems, they use different SCSI controllers. The *VAST Device* uses an 8-bit, half-length SCSI adapter card, while the *POWERstreamer IV* system uses Western Digital's 16-bit

WD-7000 SCSI controller with micro-processor augmentation. Differences in the way that each system's software handles the data and buffers that data to tape also contribute to the variance in throughput.

Both units disregarded the hidden-file attributes of certain directories when restoring the backed-up data from the server to a blank hard disk: hidden directories were no longer hidden when the files were restored. Retesting restoration of data—so that it would overwrite existing data—showed no difference in throughput.

Throughput Tests

(Results given in megabytes per minute)

	LAN Backup	LAN Restore	Local Backup	Local Restore
<i>POWERstreamer IV</i>	3.2	2.9	6.5	5.2
The <i>VAST Device</i>	1.8	1.6	2.9	2.5

All benchmark tests were run under Novell's *SFT NetWare*, Version 2.1, with 6-MHz 16M PC ATs as workstation and server. The workstation was equipped with a 30MB SCSI hard disk, while the server had a standard 20MB hard disk. 3Com EtherLink networking cards were used to link the workstation end server. The helical-scan tape-backup devices were attached to the LAN workstation.

The benchmark tests were based on a hard disk with 832 files totaling 22.3MB. These files were of assorted sizes and attributes and were located in many directories and subdirectories on the server. Some directories and subdirectories were hidden to reflect conditions on a typical network server.

The benchmark tests measure the throughput, or data transfer rates, of each helical-scan tape-backup system. The throughput is measured in megabytes per minute, so you can quickly estimate how long it would take to move your data files. Remember that higher numbers show faster throughput.

The **LAN Backup** test measures the throughput during a backup of the server hard disk's files across the network to the given backup device connected to the *NerWare* workstation.

The **LAN Restore** test measures the throughput when files are restored from the backup device connected to the given backup device to a blank disk on the server.

The **Local Backup** test measures the throughput during a backup of the workstation hard disk's files to a backup device connected directly to the workstation.

The **Local Restore** test measures the throughput when files are restored from the backup device connected directly to the workstation to a blank disk on the workstation.

the helical-scan technology compensates for the slowness of typical file-by-file transfers. Both systems copy the entire disk tree structures of multiple disks.

Though Performance Technology's *POWERstreamer IV* and Emerald Systems' *VAST Device* both use the same Exabyte tape drive, they use very different

SCSI interface cards and backup/restore software. As our test results show, these two factors make significant differences in performance and compatibility.

Each of the two tape-backup systems we tested is priced close to \$7,000. Although this seems a high price for a PC peripheral, it becomes reasonable when you

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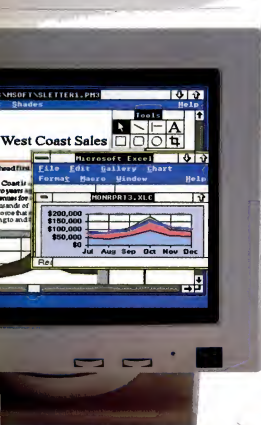


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■ 2-GIGABYTE LAN BACKUP

use one tape unit to back up data on the drives of multiple servers on a LAN. You can also use these tape drives to back up any PC-based hard disk.

EMERALD SYSTEMS CORP.

The VAST Device

At \$6,995, Emerald Systems Corp.'s VAST Device tape backup system hardware comes with the VAST tape drive in a custom external case, a half-length 8-bit-bus SCSI controller card, a 60-inch "GigaCoupler" SCSI cable, and the VAST hardware installation guide. The VAST Applications Kit is available separately for \$325. It contains the *Archival Storage Protector (ASP)* software, user manual, five tape cassettes, and a tape storage case. Application kits are available for PC- or MS-DOS 3.x, SCO Xenix, and LAN operating systems like MS-Net and Novell's NetWare.

The VAST drive unit incorporates the Exabyte EXB-8200 tape drive, a power supply, and the controller electronics for the drive in a custom case. At 5½ by 9½ by 12½ inches, the case is shorter and wider than an internal full-height AT drive bay, so the unit must be used as an external device.

Emerald supplies a half-length 8-bit SCSI adapter card with the unit. Since an extension of the SCSI cable is not available on the back of the VAST cabinet, you



The VAST Device, by Emerald Systems Corp., is an external tape drive with an 8-bit-bus SCSI controller card and a 60-inch GigaCoupler SCSI cable. For \$325 more, you get The VAST Applications Kit, which contains the *Archival Storage Protector* software and accessories.

can't daisy-chain other devices from this controller.

The ASP program, hardware driver, and support files fit on a single 360K disk. Although the software installation process is totally menu driven and easy to follow, the installer will have to determine the availability of I/O addresses, interrupt levels, and DMA channels. I/O addresses must be set by the software to match the setting on the SCSI card.

Emerald Systems recommends that when you use ASP you remove other programs from RAM and set the BUFFERS statement in your CONFIG.SYS file to the smallest value possible. This allows the software to use the maximum amount of system memory. Since you don't need to include a DEVICE statement in your CONFIG.SYS file to load the hardware driver, the program removes itself from RAM when the unit is not in use.

The setup portion of the program also includes a learn mode for creating control files for automated backups. The editor is easy to use and prompts the user for required information, automatically inserting special control codes into the file. Unfortunately, the editor is very limited and no information is provided on how to cre-

ate these files using a more powerful ASCII editor.

Possibly the best way to run the Emerald Systems backup program is to create a bootable, automatic ASP-loading diskette for each day of the week. Using this method, someone without much computer training can choose a labeled disk, insert it in the drive, reboot, and let batch processing take care of the rest.

The documentation supplied by Emerald for both the hardware and software is in the form of a step-by-step tutorial. Unfortunately, it was out of date—the software we received had been upgraded and modified in many areas only vaguely described in an addendum to the manual. This significantly decreases the worth of an otherwise valuable tool for learning the program.

BACKUP OPTIONS ASP makes five backup options available to the user. You can elect to back up an entire disk, selected directories and files, or only files created or modified after a specified date. The Master-Archive option will back up an entire disk, turning off each file's archive bit. You can then use the Change-File option to back up only those files which have the archive bit on. Together these last two op-



FACT FILE

The VAST Device

Emerald Systems Corp.
4757 Morena Blvd.
San Diego, CA 92117
(619) 270-1994

List Price: Hardware, \$6,995; software, \$325.

Requires: 512K RAM, 80286- or 80386-based PC, Xenix or DOS 3.1 or later.

In Short: The VAST Device is a 2.2GB 8mm tape-backup system that can be compatible with DOS, SCO, or Xenix, or LAN operating systems. It features menu-driven software, password-protected save sets, and an 8-bit-bus SCSI interface card. Only a single drive unit is addressable.

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CIRCLE 123 ON READER SERVICE CARD

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■ 2-GIGABYTE LAN BACKUP



2GB Tape-Backup Systems for LANs: Summary of Features

	POWERstreamer IV Performance Technology Development Inc.	The VAST Device Emerald Systems Corp.
Complete LAN package price	\$6,953	\$7,320
Cartridge type	8mm video	8mm video
Capacity	2GB	2GB
Tape drive subsystem	Exabyte EXB-8200	Exabyte EXB-8200
Hardware available separately	●	○
Software packages available	DOS 3.x, LAN	DOS 3.x, LAN, SCO Xenix
Max. no. of drives	16	1
Drive types supported	Exabyte SCSI, Patriot, QIC 02, QIC 36	Exabyte SCSI
Controllers supported	Adaptec AHA-1540 SCSI, Everex EV-811 QIC-02, Everex EV-831 QIC-36, Western Digital WD-7000 SCSI	Emerald Systems
RAM required	640K	640K
EMS memory supported	●	○
Hardware drivers	Installed in CONFIG.SYS	Called by program
Menu-driven installation	○	●
BACKUP FEATURES		
File-by-file backup	○	●
Image backup	○	○
Menu backup	●	●
Batch-mode operation	●	●
Menu restore	●	●
File comparison for verification	●	●
FILE SELECTION		
Disk	●	●
Directories	●	●
Wildcards	●	○
By exclusion	●	○
Time and date	●	●
Archive bit	●	●
Read-only bit	●	○
Hidden bit	●	○
System bit	●	○
Can change archive bit after backup	●	●
OTHER FEATURES		
Tape password protection	○	●
Directory on tape	●	●
Electronic label on tape	○	●
Quick tape erase	○	●
Security tape erase	●	●

●—Yes ○—No

tions supply a means of daily record keeping maintenance.

The program will only allow 32 selections per backup session; additional backup operations are required if more than 32 path or file entries are needed. File selection may be based on filenames, time and date stamps, or archive bits, but not on other attribute flags such as read-only, hidden, or system. You can only include files you want to back up; you can't reverse the process and exclude specific files.

You can restore entire save sets or selected files within the sets to the original disk location, to a new directory on the disk, or to a new disk. You also have the option of overwriting the files marked read-only, but when ASP encounters files

■ **ASP's quick erase**
takes about 1½ minutes,
leaving the data
inaccessible by normal
means. The security erase
function takes 4 hours.

on the target disk with hidden or system attributes, the program pauses and prompts the user for permission to overwrite them. If you do not take the time to select only the nonsystem and nonhidden files, the program will require constant user interaction during the restore operation.

ASP offers two erase functions. A quick erase takes about 1½ minutes and deletes only the tape header information. The data is still on the tape but not accessible by normal means. The security erase function takes 4 hours to completely erase all data on the tape.

During most operations, ASP creates directory files on the hard disk of its host; however, these files are deleted after the operation is complete. ASP will create and maintain activity log files. The user has the option of specifying how many of these files will be maintained and the directory in which they will reside.



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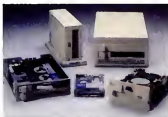
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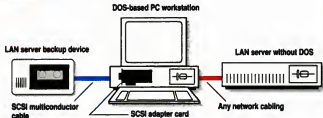
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LAN Server Backup Topology

(Media: Any network cable)



Network operating systems like Novell's NetWare or Banyan's VINES don't use DOS on the server. In these networks, a high-capacity tape backup system is attached to a DOS-based PC workstation via an SCSI interface. Data to be backed up moves from the server over the LAN to the workstation. A high-capacity tape backup system can be attached directly to the server in networks that use DOS-based LAN operating systems on the server. Since data doesn't have to move across the network, data transfer rates are much faster in such a setup.

PERFORMANCE We had two significant problems with The VAST Device. Although the system worked fine with an 8-MHz IBM PC AT, it performed erratically when we tried to use it with a Dell System 200 machine operating at 12 MHz. Secondly, the ASP software is sensitive to TSR programs, and we experienced several system crashes caused by software conflicts. If you run VAST in a clean, slow machine, you shouldn't have problems.

ASP worked very well with Novell's NetWare Bindery files. Files not shared by the network were not saved, and the log file reflected this; however, hidden directories were copied with no problems. Although not the faster of the two units we tested, the system transfers files and accepts unusual attributes without problems. The results of our LAN Backup benchmark test shows a throughput, or a data transfer rate, of 1.8MB per minute. VAST's performance on our Local Backup test is faster—2.9MB per minute—because the data doesn't have to travel across the LAN and because of the faster SCSI disk on the local PC.

When network messages are received during any operation, the ASP software temporarily stops execution. As soon as the user acknowledges the message, program execution resumes. To cancel pro-

gram execution, simply press the Esc key; the program will prompt the user for confirmation of the cancel order.

The VAST Device is sensitive to its host computer environment, but if you use it on the right computer and follow the right administrative processes, it works reliably both through a network and attached to a local computer.

PERFORMANCE TECHNOLOGY DEVELOPMENT INC.

POWERstreamer IV

Performance Technology's POWERstreamer IV tape system is available as a complete LAN package for \$6,953; however, you can purchase the components individually. The LAN package includes the Exabyte EXB-8200 tape subsystem, external case and power supply, SCSI adapter card, SCSI cable, and the TAPEvol and LAN POWERSave software packages.

The TAPEvol software contains a collection of drivers for several tape subsystems, including the SCSI controller drivers required for the Exabyte EXB-8200 tape system reviewed here.

The LAN version of the POWERSave software can handle a maximum of 16 tape drives, making it possible to back up an incredible 32.704GB of data in one opera-

tion without changing tapes. If you have only one tape drive and don't mind changing tapes, you can use up to 100 tapes in a single session, because the system will prompt you to change the tape when the working tape is full.

The number of files that you can back up in one session depends on the configuration of available system memory, however. You can back up about 40,000 files for every 1MB of EMS memory; 640K of conventional RAM handles about 8,000 files. The software is able to use all available EMS memory, and any size file or disk can be backed up as long as its contents fit on a combination of 100 tapes.

■ **LAN POWERSave** can handle a maximum of 16 tape drives, making it possible to back up an incredible 32.704GB of data in one operation without changing tapes.

The Netsave program, which is included in the LAN POWERSave package, can back up data from any local or remote disk drive that is shared as a network drive, provided the files are not open for a shared task or a write operation. This means that the network does not have to be off-line during backup. When the Netsave program opens a file, it sets the read-only, deny-write MS-DOS file status conditions. If a file is open in a mode that prevents Netsave from gaining access, an Open error occurs, and the filename and error condition are logged.

We didn't find the Netsave program easy to use—it is unforgiving when you try to use it interactively. To perform a successful backup operation, it's critical that you enter the input instructions in the proper order. If you make an error while entering an instruction, the program exits with an error message, and you have to reenter

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Ethernet	Arcnet
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LAN Software

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■ 2-GIGABYTE LAN BACKUP



Performance Technology's POWERstreamer IV tape system includes the Exabyte EXB-8200 tape system, complete with power supply and external case, a full-size SCSI adapter, SCSI cable, and the TAPEvol and LAN POWERsave software. You can also buy the components separately.

the entire instruction set. To save yourself a lot of frustration, we recommend that you use a prepared ASCII input file to control the program.

Netsave does have some nice features. You can select files for backup using wildcards, filenames/extensions, attributes, dates, and times. If you prefer to select files for future backups by the status of the archive attribute, you can clear the archive bit of these files as you back them up. You can later back up only those files for which the archive bit has been set.

UNATTENDED BACKUP You may select specific tape drives as targets for the backup of single or multiple drives. It is also possible to initiate unattended backups at specified times by using batch commands, input files, error-log output, and validation of the data written to the tape. This method is preferable because it allows nontechnical people to control backups. Any errors in files backups are logged.

Unlike the Netsave program, the Net-restore program included in the POWERsave software is very easy to use. This menu-driven program can run comparison tests on files as well as restore your data to disk, but it isn't meant to be used with batch processing and doesn't accept redirected input.

The PCRestore menu presents a directory listing similar to the MS-DOS tree command, displaying the names of all disks, directories, and subdirectories. A single keystroke will display all the files

■ The PCRestore program lets you restore files regardless of whether their original directories exist or not—the target directory is created if necessary.

contained within each directory or subdirectory. You may select either the entire tape tree, entire disk trees, specific directory trees, single directories, single files, or any combination for comparison or restoration. To make this process even simpler and more powerful, generic file specifications are also selectable.

You can restore files regardless of

whether their original directories exist or not—the target directory is created if necessary. The PCRestore program terminated when asked to overwrite existing hidden directories. While abrupt termination of a program due to an error is always irritating, you can avoid the situation by selecting hidden files for restoration.

The Performance Technology manuals are organized in a logical format and are loaded with helpful examples of commands and batch files. Hardware and driver software installation is covered in great detail. Even though the manual lacks an index, we found that referencing information was not a problem.

MIXED MEDIA Performance Technology's modified version of the full-length Western Digital WD-7000 SCSI controller card has a special ROM BIOS that improves the transfer rate of data. The many drivers supplied by Performance Technology in these software packages and others allow you to combine different controllers and drives in a mixed set of different media sizes, capacities, and electrical interfaces. This increases the ability to incorporate new controllers and drives into an existing system.

Our Local Backup benchmark test results showed disk-to-tape throughput at rates of 6.8MB per minute. Going through the network slowed the throughput as expected, but we still recorded an impressive 3.15MB per minute in our LAN Backup

benchmark test. These throughput figures are an average, using a "worst-case" file base. If the drives have large files and simple directory structures, throughput could increase to 15MB per minute.

Novell Bindery files caused no problems except for files that were in a locked-open status. A complete listing of files was bypassed, and the error condition that caused it was recorded in the error log. Al-

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FACT FILE

POWERstreamer IV

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San Antonio, TX 78230
(512) 349-2000

List Price: \$6.953

Requires: AT compatible, 512K RAM,
DOS 3.1 or later. LIM EMS memory
optional.

In Short: The POWERstreamer IV is a very
fast 3GB tape-backup system with batch-
processed backup and menu-driven restoration.
It offers very powerful command options. Up
to 16 tape units of assorted media types and
controllers are addressable.

CIRCLE 654 ON READER SERVICE CARD

CIRCLE 221 ON READER SERVICE CARD

■ 2-GIGABYTE LAN BACKUP

though errors were encountered when the system tried to find hidden directories, the files contained in them were faithfully saved with no problems.

Restoration to a blank disk drive was performed with no errors except that the previously hidden directories were no longer hidden. The POWERstreamer IV ran just fine on a 12-MHz Dell System 200 computer.

We tried other techniques to torment the software, with little success. When we sent network messages to the workstations, the backup program temporarily suspended operation but resumed backup after acknowledging the network message. We also tried to shut down server activity during a remote backup operation. The Novell server faithfully reported open files and asked for confirmation of the shutdown order.

When the network server crashes during a backup, it is natural to assume that

■ When the server crashes during a backup, it is natural to assume that the entire operation was a wasted effort.

This was not the case with the POWERstreamer IV.

the entire backup operation was a wasted effort. This was not the case with the POWERstreamer IV. The files that were saved before we crashed the server remained on the tape, and the tape header

contained the entire directory listing of all disks and files requested for backup. Only during file comparison did we determine the actual number of files saved. Since the log file is created only after backup has been completed, and since we turned off the computer during backup, no log file existed.

Performance Technology's POWERstreamer IV works reliably and quickly in both the Novell LAN and the DOS LAN environments. We wish that the Netsave software were more forgiving when backing up files in interactive mode, but this is only a minor complaint since you're likely to use an ASCII script to automate the backup job.

Kellyn Betts is a staff editor for PC Magazine. Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine. C. G. Milligan is a technical writer based in Destin, Florida.

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What's Old Is New

The AT bus is back, and anyone with any kind of attachment to the old AT will say it's about time. But IBM's new PS/2 Model 30 286 marks more than a mere revival of the vintage AT bus. It's a compelling low-cost computer—just under \$2,000 without a hard disk—that reveals yet another new marketing strategy for America's premier PC manufacturer.

When IBM introduced its PS/2 line on April 2, 1987, it signed the death warrant for the popular 16-bit bus of the AT. With-

in months IBM machines with the bus that had been introduced less than 3 years earlier (on August 14, 1984) disappeared, replaced by a two-pronged attack from the new PS/2s—the 8-bit Models 25 and 30 on the low end and the Micro Channel-based Models 50 and up on the high end.

When the reigning industry standard was abandoned by its inventor, the compatibles industry went on a rampage. Computer makers capitalized on the installed base of AT-bus products and on their ex-

IBM's PS/2 family has a new member—with an AT bus. The PS/2 Model 30 286 is sleek, cheap, and controversial; why has IBM brought the AT bus back to life?

■ IBM PS/2 MODEL 30 286

perite in extracting ever higher performance from the well understood bus. By offering both bargain-basement ATs that undercut the low-end PS/2s and racy 80386-based machines that outdistanced the high-end models, the compatible makers cut IBM's share of the personal computer market from nearly 40 percent to about 26 percent in little more than a year.

The appearance of the Model 30 286 appears to be slated to reverse that trend. The reintroduction of the AT bus in the aggressively priced Model 30 286 could be an IBM counter attack. It may be a loss leader meant to undercut compatibles makers.

On the other hand, the Model 30 286 may mark a different trend. It could be an admission of a massive mistake by IBM's marketing mavens—underestimating the merits the marketplace attributed to the old bus. It could indicate the start of the downfall of Micro Channel and a return to the classic bus, a change that may leave IBM behind the rest of the personal computer

industry and stamp the Micro Channel as the second-generation PCjr.

Then again, the Model 30 286 could be a strategic masterstroke, the full reach of which cannot yet be understood. Or it just may be a good computer, at a good price, that will win space on office desktops worldwide.

Depending on which pundit you believe, the Model 30 286 could be any one of these. Because tight-lipped IBM won't reveal its reasons or strategies, the real story has to be pieced together from the evidence at hand. And the best evidence is the Model 30 286 itself.

JUST ANOTHER PRETTY CASE At first look, the Model 30 286 is unmistakably a full-fledged member of the PS/2 family. It features the same compact, squared-off styling of the other desktop PS/2s, a flat box compromised only by a slight diagonal overhang on the front panel. In a word, it's trim. Just large enough to fit under a VGA display, its case measures

a mere 4 by 16 by 15½ inches (HWD)—a about a third the volume of an AT. It sports the same bleached-beige paint as the rest of the PS/2 line. It's a twin to its namesake, the original Model 30.

As with the rest of the desktop PS/2 line, standard equipment puts a high-density 3½-inch floppy drive near the middle of the front panel. The optional hard disk lies just to the right, with the activity indicator of the hard drive showing through a notch in the panel, and a row of slots cut into its faceplate to allow cooling air to circulate inside. On the far right, a white paddle-style power switch completes the front-panel controls and decor.

Around the corner on the right side of the case, just behind the front fascia, is a flat keylock that should prevent ardent interlopers from prying inside the case. As with other PS/2s, the lock does not control the keyboard. That's left to the password system built into the system's hardware.

The case of the Model 30 286 is mostly steel and has earned FCC Class B certification, meeting the tougher residential-level emission standards. The actual chassis is a stamped bottom plate that wraps up to become the inside of the front and rear panels, and folds about ¾-inch up the right and left sides. Both the front and back of the machine are covered with decorative plastic fascia panels, off-white up front, brown in the rear.

The top of the case is steel as well. It folds down to cover the right and left sides and is secured just behind the front panel by a single Phillips capture screw on either side. Loosen the screws, and the top slides back half an inch to be lifted up and off.

Unlike the Model 50, which literally snaps together, the Model 30 286 is screwed together with conventional hardware on the inside. The system board, for instance, is bolted directly to dimples in the bottom of the chassis.

This system board installation proved the only flaw in IBM's otherwise exemplary workmanship in the review sample Model 30 286. Of eight bolts that should have held the system board in place, only seven were in place. The hole for the missing bolt was properly threaded in the chassis, but the mounting holes in the system board and in the chassis did not line up properly. Apparently the mechanical en-



IBM PS/2 Model 30 286 vs. Model 30 and Model 50: Summary of Features

(Products listed in ascending price order)

Basic configuration	IBM PS/2 Model 30	IBM PS/2 Model 30 286	IBM PS/2 Model 50
List price	\$2,395	\$2,595	\$3,595
RAM	640K	512K	1MB
Floppy disk drives	One 720K 3 1/2-inch	One 1.44MB 3 1/2-inch	One 1.44MB 3 1/2-inch
Hard disk	20MB	20MB	20MB
Software included	Setup, diagnostics	Setup, diagnostics	Setup, diagnostics
On-board video adapter	MCGA	VGA	VGA
Ports	One serial, one parallel, one mouse	One serial, one parallel, one mouse	One serial, one parallel, one mouse
Slots	Three 8-bit	Three 16-bit	Three 16-bit
Specifications			
Clock speed	8 MHz	10 MHz	10 MHz
16-bit memory implementation	None	4MB on system board, 12MB in expansion slots	1MB on system board, 15MB in expansion slots
Math coprocessor	8087	80287	80287
RAM chips	DRAM	DRAM	DRAM
Other			
Warranty	1 year	1 year	1 year
FCC certification class	B	B	B

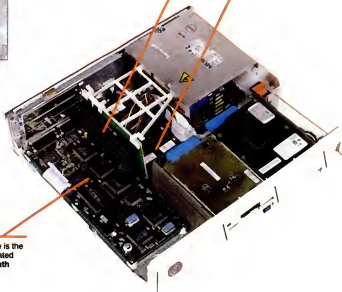


Bringing Back the Bus: Inside the PS/2 Model 30 286



The IBM PS/2 Model 30 286 marks IBM's first use of the standard bus it abandoned when the Micro Channel bus was introduced. At \$2,595 with a 20MB hard disk, this computer's **passive vertical AT-style expansion backplane** guarantees compatibility with traditional add-in cards.

Although it's only 75 percent as large as an AT system board, the Model 30 286 board incorporates such features as the **VGA video system**. **System ROMs** can be found above the on-board VGA.



The brains of this 10-MHz machine is the **Intel 80286 microprocessor**, situated below the socket for an 80287 math coprocessor.

gineers of the system board and the chassis didn't see eye-to-eye on this one. This nearly insignificant problem will likely be cleared up in later production runs.

SPACE CASE Inside its case, the Model 30 286 is elegantly spare. Although it lacks the wireless design of the Model 50, it doesn't suffer from the snake's nest of cables found in many compatibles. In fact, the box appears almost empty—a case full of space. That airy look is a tribute to a

well-thought-out wiring arrangement. For example, the floppy-disk control cables, which connect to the left side of the system board, are folded underneath it and out of sight. The hard-disk cable is split in half lengthwise, not to twist and reorient its connectors, but to make it lie flat against the power supply.

Only the video cable and power-supply cables run through the free space. The video cable emerges about midway down the right side of the system board and then flies

to the center of the rear panel, wearing as a bracelet a large (1 1/2-inch-long) ferrite tube that helps eliminate radio frequency emissions on the video cable running to the monitor.

The power-supply cabling runs to two connectors on the system board; one is a miniaturized version of the two standard power-supply connectors of the PC and AT systems, but merged so they cannot be inadvertently and disastrously switched. The other power cable functionally dupli-

One solution to three



The new IBM PS/2 Model 30 286.

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Not only can the new IBM Personal System/2® Model 30 286 run your DOS applications, it can run them fast. In fact, it's a system that's up to twice as fast as the popular PS/2® Model 30, thanks to its advanced technology and 286 chip.

What's more, as your needs grow, so can your system. Its power can be extended by adding up to 4Mb of memory right on the system board.

It's a high performance system without a high price tag.

Affordability

The new Model 30 286 comes with many standard features that are optional on other systems in its class. For example, dazzling VGA graphics, as well as printer, communications, and mouse ports are all built into the system, so option slots are free for other uses. You also get a performance-boosting disk cache to help "turbo-charge" some of your applications.

And, of course, you get PS/2 quality and reliability, which helps make short work of your long-term decision.

One other small feature comes standard, too. The Model 30 286 costs less than you might expect, which makes it an affordable choice for everyone.

And, since this system works with much of the software and hardware you may already have, you'll be getting the most from your IBM investment.

Compatibility

The new Model 30 286 runs most of the DOS applications you use today, like Lotus 1-2-3®, Display Write™, Microsoft® Works and dBase®. It accepts a variety of PC AT® expansion cards, and like the other entry level PS/2 models, many PC and PC XT™ cards as well.

Yet the Model 30 286 fits right in with the rest of the PS/2 family. It can communicate with the most advanced personal systems and can be configured to run IBM's OS/2™ versions 1.1.

For complete details about the Model 30 286 or any of the more advanced members of the PS/2 family, contact your IBM Authorized Dealer or IBM Marketing Representative. For a dealer near you, call 1-800-IBM-2468, ext. 101. You'll find that the new Model 30 286 is an investment that's *right for today, ready for tomorrow.*

The IBM logo, consisting of the letters "IBM" in a bold, sans-serif font, with horizontal lines through the letters.



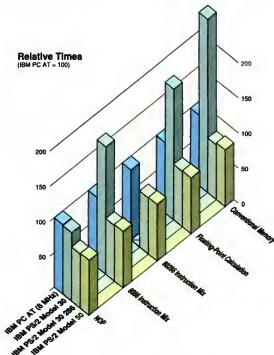
Benchmark Tests: IBM PS/2 Model 30 286

IBM's new addition to its PS/2 line places an AT bus in the slim chassis of the PS/2 Model 30. The IBM PS/2 Model 30 286, which sports a 10-MHz 80286 processor, demonstrates its superior performance on the NOP test, processor tests, Floating-Point test, and Conventional Memory test. No expanded or extended memory test was run because the computers in our comparison group did not provide for these features in their standard configurations.

The disk benchmark tests indicate that the IBM PS/2 Model 50 is equipped with a faster-performing hard disk. On both the small- and large-record runs of the DOS File Access tests, the Model 50 tested consistently faster than its two PS/2 competitors. Even on the DOS Disk Access test and the BIOS Disk Seek test, the Model 50's hard disk outclasses that of the new Model 30 286.

On the video tests the Model 30 286 generally outperformed the Model 30, but once again couldn't keep up with the Model 50. Although the 80286 processors of the PS/2 Models 50 and 30 286 run at 10 MHz, the results of the video tests point to a difference in bus performance.

Relative Times
(IBM PC AT = 100)



Processor and Memory Benchmark Tests

Performance Times (Times given in seconds)

	NOP	8086 Instruction Mix	80286 Instruction Mix	Floating-Point Calculation	Conventional Memory
IBM PC AT (8 MHz)	4.23	8.95	8.84	35.43	1.29
IBM PS/2 Model 30	4.17	16.26	N/A	65.91	3.18
IBM PS/2 Model 30 286	3.30	7.14	7.09	28.01	1.00
IBM PS/2 Model 50	3.35	7.28	7.17	28.34	1.04

N/A—Not applicable: this computer does not support an 80286 processor.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **80286 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

Disk Benchmark Tests

Performance Times

(Times given in seconds except where noted)

	DOS File Access (small record)	DOS File Access (large record)	DOS Disk Access (milli- seconds)	BIOS Disk Seek (milli- seconds)
IBM PC AT (8 MHz)	70.71	16.74	42.79	37.40
IBM PS/2 Model 30	124.52	26.01	96.29	82.61
IBM PS/2 Model 30 286	110.46	19.94	96.12	83.12
IBM PS/2 Model 50	100.12	12.15	82.58	80.14

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In the case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

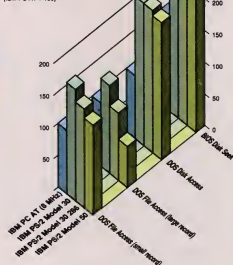
The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

Relative Times

(IBM PC AT = 100)



Video Benchmark Tests

Performance Times

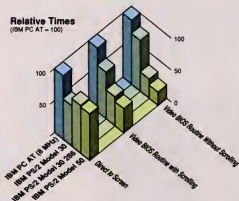
(Times given in seconds)

	Direct to Screen	Video BIOS Routine with Scrolling	Video BIOS Routine Without Scrolling
IBM PC AT (8 MHz)	9.06	11.26	7.25
IBM PS/2 Model 30	5.82	8.24	5.76
IBM PS/2 Model 30 286	6.67	5.16	2.20
IBM PS/2 Model 50	6.65	4.34	1.54

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.





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ates a disk-drive power cable, again with a miniaturized connector. Drive power is delivered to the system board and distributed to the floppy and hard disks through their signal cables. Installing either a hard or a floppy disk drive thus requires tangleing with but one cable.

The system board itself looks tinier than those found in other IBM computers—in particular that of the original PC—even though the dimensions of the Model 30 286 and PC system boards match at 8½ by 11 inches. Although it's about 25 percent smaller than an AT system board, the Model 30 286 board incorporates many additional on-board functions, including the parallel, serial, and mouse ports, the floppy disk controller, and the VGA video system.

This downsizing is attributable to the nine ASICs (application-specific integrated circuits) that dominate the sparsely populated board along with about a dozen support chips. About the only chips that are not miniaturized surface-mount components are the few that are socketed, such as the three ROMs (two BIOS, one keyboard), the microprocessor, and the optional 80287 numeric coprocessor.

Only one nonstandard expansion connector is available on the system board. It serves as the base for a daughtercard that holds three AT-style expansion connectors. Each of the three accepts a full-length, full-height AT board. Boards fit into the slots horizontally, running front to back in the conventional way. All three of these slots are available for adding options in both the standard and hard disk-equipped Model 30 286s.

The daughtercard-expansion connector assembly is held in place by a snap-down plastic flying buttress that's rooted in the power supply. Expansion cards are kept in place by a combination of their expansion connectors, their card retaining brackets, and molded plastic card guides permanently affixed at the front of the slots. Although this system should hold full-length cards rigidly in place, the mounting for shorter cards (which won't reach the card guides) won't be nearly as secure. You'll want to be sure to screw the retaining brackets of expansion cards tightly into place in the Model 30 286.

A potential problem with horizontally

mounted expansion cards is that they tend to hinder convective cooling. Although heat buildup should be no more troublesome in the Model 30 286 than in any other small-footprint computer that uses horizontal slots, you'll probably want to put the most power-hungry expansion cards in the top so you don't slowly fry them.

The two 3½-inch drive bays are part of a molded plastic shelf that serves as the foundation for a drive mounting system that requires no hardware. As with other PS/2s, drives slide and latch into place on plastic sleds.

ELECTRIC TRICKS The brain of the Model 30 286 is an 80286 microprocessor that's rated at 10 MHz. Unlike other IBM 80286-based computers, the chip in the Model 30 286 uses the Plastic Leadless Chip Carrier (PLCC) package instead of the Pin-Grid Array (PGA). The new package has many short, folded legs that sprout from all four sides of the chip and press against mating contacts in its socket. The PGA package uses a matrix of gold-plated pins on its bottom surface.

The new package is less expensive to manufacture and less susceptible to damage when the chip is inserted and removed. However, it confounds many 80386-based accelerator board upgrades, which are designed for the PGA package and may require adapters for the PLCC of the Model 30 286.

Adjacent to the 80286 is a DIP socket for an 80287 numeric coprocessor. The Model 30 286 runs its coprocessor at full microprocessor speed, 10 MHz. Both expansion bus and memory also run at this rate, although the memory imposes 1 wait state on the microprocessor.

The microprocessor, coprocessor, and memory speeds of the Model 30 286 exactly parallel those of the Micro Channel Models 50 and 60 (but not the new zero-wait-state 50Z). In single-thread applications, the two classes of machine achieve identical performance, about 25 percent faster than an 8-MHz AT and 50 percent faster than the original Model 30.

System memory is physically located near the opposite edge of the board from the microprocessor, next to the power supply. All system-board RAM is installed as Single In-line Memory Modules (SIMMs)

with parity checking. The Model 30 286 supports both 256-kilobit and 1-megabit SIMMs, with the former used for the standard 512K of RAM. In the evaluation unit, these appeared to be standard SIMMs made by Oki rather than the proprietary IBM memory modules used in the more exotic PS/2s.

SIMMs must be added in pairs and are rated at 120 nanoseconds. SIMMs of different capacities cannot be mixed on the system board, so allowable capacities beyond 512K are 1, 2, and 4MB.

Additional 16-bit memory can be added in the expansion slots, with no performance penalty over that on the system board. Maximum system capacity is 16MB, the addressing limit of the 80286 microprocessor.

Another 256K of memory is attached to the system board to serve the needs of the built-in VGA system. The necessary eight 4-by-64-kilobit chips are soldered to two flaplike daughtercards that are, in turn, both soldered to the system board near the main RAM.

IMPECCABLE COMPATIBILITY The system BIOS was, of course, written by IBM. As with all IBM computers, it includes a rudimentary version of BASIC built in. By definition, the Model 30 286 has perfect IBM compatibility.

The VGA circuitry of the Model 30 286 also scores with impeccable compatibility. Besides BIOS compatibility with all IBM video standards, including MDA, CGA, and EGA, the VGA circuitry extends system graphics resolution to 640 by 480 pixels in 16 colors and to 320 by 200 in 256 colors (selected from a palette of 256,000). Text resolution can be up to 720 by 400 pixels. As with all VGA systems, the Model 30 286 produces analog signals with a 31.4-kHz horizontal frequency; it requires VGA monitors or compatible multisync-style displays for proper operation. The Model 30 286 will work either with color or monochrome VGA displays with equal ease, but no monitor is included in the price of the system.

Using special feedback signals in the video cable, the VGA circuitry automatically detects whether a monochrome or color display is attached. (For monochrome displays, colors are rendered in 64

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■ IBM PS/2 MODEL 30 286

shades of gray using the green channel of the color signal.) Unlike some other IBM VGA systems, however, that of the Model 30 286 will display monochrome-only modes on color displays.

Although the system uses a full 16-bit data bus, access to the VGA circuitry is through an 8-bit path. Teletype-mode video routines (those that use the code in the BIOS firmware) run twice as fast as their equivalents on the XT Model 286 but at a fraction of the speed of high-end PS/2s with BIOS shadowing abilities. (The 80286 does not lend itself to shadowing ROM memory as the 80386 does.) However, direct memory writing speed for the Model 30 286 is nearly identical with that of 80386-equipped PS/2s.

The two input/output ports built into the Model 30 286 system board follow the prevailing PS/2 practices rather than those of the AT. The serial port operates at speeds up to 19,200 bps (with official IBM sanc-

tion—the ports can be driven faster by special software) and terminates at the back of the chassis in a 25-pin male D-shell connector. The parallel port is bidirectional and uses a 25-pin female D-shell. Both the standard keyboard and the mouse ports use PS/2-style female 6-pin miniature DIN connectors. The video output uses a female high-density 15-pin D-shell.

DISK DRIVES The standard floppy disk drive is manufactured by ALPS, the printer people. It's virtually interchangeable with any of the half-dozen other high-density 3½-inch floppy disk drives currently on the market. Its 1.44MB capacity is twice that of the original Model 30, the same as the Micro Channel PS/2s.

The floppy disk controller on the system board can operate up to two floppy disk drives, but the cable inside the Model 30 286 has but one floppy-disk-drive connector on it. Adding a second floppy disk

drive will require a new cable. IBM does not currently offer a second drive for this system.

The optional 20MB hard disk is manufactured by IBM. A rather unremarkable product, it is obviously engineered for reliability rather than for performance. The one in the evaluation machine didn't even achieve its 80-millisecond average access-time rating in testing, dragging along at about 83 ms.

The IBM hard disk uses an embedded interface and Modified Frequency Modulation (MFM) to achieve a data transfer rate of 5 MHz. The interface itself provides only an 8-bit data path compared with the 16-bit path used in the AT.

Embedding the interface puts all of the controller electronics on the drive itself. The drive then connects to the system through a cable that merely ties in to an extension of the expansion bus. Adding a hard disk to the standard Model 30 286 (it

STOP WAITING ON TABLES.

	1982	1983	1984	1985	1986
Net sales	\$ 263,537	\$ 277,545	\$ 326,268	\$ 425,654	\$ 481,111
Expenses	303,111	311,111	313,111	313,456	371,111
Loss	(39,574)	(33,566)	(86,843)	112,198	109,967
Loss rate	4.8%	4.2%	26.6%	45.7%	42.2%
Taxes	18,111	18,111	18,111	(51,274)	(46,111)
Net income	(\$23,111)	\$ 10,502	\$ 31,504	\$ 60,924	\$ 62,111
Earnings	\$ 0.02	\$ 0.32	\$ 0.53	\$ 0.93	\$ 0.92
Prices	55.211	57.034	58.764	65.465	65.111

lacks one) will thus require either a drive with an embedded controller or a controller on an expansion card. High-performance 3½-inch drives with embedded controllers are now becoming available with transfer rates up to 10 MHz and capacities over 100MB.

The Model 30 286 hard disk is low-level formatted with an interleave of two—compared with the drives of the AT, XT 286, and the original Model 30, all of which used an interleave factor of three.

Unlike the AT and the XT Model 286, the Model 30 286, like the earlier Model 30, relies on its DMA controller for transfers between the system and its hard disk. All such transfers must be made in the 8-bit mode of the DMA system. Overall, the hard disk performance of the Model 30 286 tests out slightly worse than that of the XT Model 286 and far behind the AT.

To overcome the slow-access encumbrances of the Model 30 286 hard disk,

IBM supplies a disk-caching program on the Reference Disk that accompanies the machine. Using it will give much faster apparent drive performance when reading from the disk but not when writing, because the IBM cache does not work on

■ More than two disk drives cannot be added to a Model 30 286 simply because there is no space.

writes. The program installs as a device driver in the system's CONFIG.SYS file. A second program is supplied to set up the cache automatically.

Other than hard disk cards and external

units, more than two drives cannot be added to a Model 30 286 simply because there is no space. Moreover, because of the non-standard power scheme, any add-in hard disk or replacement floppy disk drive for the Model 30 286 will require special connectors or adapter cables to match them to the system.

Drive and other expansion options are also limited by the somewhat meager reserves and lack of drive power connectors from the 90.75-watt Delta Electronic Industry Co., power supply. But stick with what's inside the Model 30 286 and you should encounter no problems. Because of the low power required by the highly integrated system board and the lower consumption of the 3½-inch drives, the full 22.5 watts at which AT slots are rated should be available from each of the three slots inside the Model 30 286.

As with other IBM power supplies, that of the Model 30 286 is a sealed steel box,

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■ IBM PS/2 MODEL 30 286

located in the right rear of the chassis. Unlike other recent IBM power supplies, this one is not autoranging. Instead, a switch on the rear panel allows the selection of one of two operating voltage ranges, 90–137 or 180–265 volts at 50 to 60 Hz. Also of note, the white power paddle on the front panel is connected to the power supply only indirectly, linked to a similar orange paddle inside the case of the Model 30 286 by a stiff wire arm.

The IBM keyboard follows the 101-key Enhanced layout and features the renowned IBM feel. It yields positive over-center action and a distinctive click with each keypress. It's the leader among computer keyboards.

System setup is handled by a series of programs on the Reference Diskette, which is included with every system. This disk also includes an elementary tutorial, diagnostics, the hard-disk-caching program, and, hidden from casual users, a

hard-disk low-level formatting routine.

As with all PS/2s, system setup is completely controlled by this software. No DIP switches or jumpers are needed. The setup software includes both automatic and manual options. The setup memory as well as

■ The keyboard follows the 101-key Enhanced layout and features the renowned IBM feel.

the continuously running time-of-day clock are kept alive when the system is switched off by a lithium battery on the system board.

The only jumper on the system board is

reserved for emergency use. If you program a password into the computer and then forget it, all you need do is move the singular jumper found near the left-front corner of the system board from one of its positions to the other to reset the password memory.

NOT AN AT Even a casual look at the Model 30 286 discloses that it's not what many people think—a new or resurrected AT. In fact, the only resemblances between the Model 30 286 and the original AT are its bus and its compatibility. Nearly everything else about the new machine is different. It's styled as part of the new PS/2 family in a compact case. It runs more quietly than the AT. It's designed to run three times longer without failures. Even its vital circuitry is distinctly new, although functionally similar—the AT's overabundance of chips condensed into a handful.

From the standpoint of market position-

DON'T JUST SIT THERE.

Calculating

Spell Checking

Sending

Searching

ing, too, the Model 30 286 is definitely not an AT. The AT—which, if you've forgotten, stands for Advanced Technology—was (to compound clichés) a computer at the leading edge of state-of-the-art. At its introduction it was the top-performing personal computer available. The AT was originally envisioned as a multi-user computer, a minicomputer in disguise.

The Model 30 286 has no such high pretensions. It's a single-user system at heart. It doesn't even aspire to being a multitasking miracle. IBM's own promotional materials call it "IBM's premier DOS machine," hinting that it should not be considered an OS/2 engine—notwithstanding its ability to run IBM's OS/2. The glory and the power are left to the Micro Channel line of PS/2s.

Although the Model 30 286 can outperform the original AT, this is not a performance computer. It's about half as fast as today's high speed norm, the 20-MHz

80386. Even if it were quicker, it would still drag its laggardly hard disk like an anchor behind it.

Rather than the new AT, the Model 30 286 is more a copy of the XT Model 286. It combines a medium-performance micro-

■ Even a casual look at the Model 30 286 reveals it's not what many people think—a resurrected AT.

processor (by today's standards, at least) with low-performance mass storage (ditto). It simply packs more processing power into the same size case as its slower predecessor, just another evolutionary step

from slime mold to synthetic brain. Although power users saw the XT Model 286 as an odd anachronism, it sold like Yellowstone wildfire to practical-minded business users. IBM probably hopes to find the same success with the Model 30 286.

Another label that's been appended to the Model 30 286 is that the machine represents IBM's attempt at cloning an IBM clone. As such, it does bear more than a superficial resemblance to several small-footprint ATs, among them Dell's current 20-MHz Model 220 and the 2-year-old Unisys (formerly Sperry) PC/microIT small-footprint.

Consider performance alone, and the Model 30 286 is a match for the Unisys. But two years of development have pared down both the hardware (the PC/microIT was jam-packed with wires, circuits, and floppydust) and the price. The Model 30 286 wears a list price \$2,000 lower than

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■ IBM PS/2 MODEL 30 286

the PC/microIT with a roughly equivalent hard disk. Compared with the Dell, the Model 30 286 is a slug, running at half the speed—but again at half the price.

Although it bears the features of the better clones, the Model 30 286 is more a continuation and extrapolation of the low-end PS/2 line. It's no more a clone's clone than the original Model 30. The similarity to other manufacturers' products better shows a marketing convergence. The common design elements—compact design, 3 1/2-inch disks, more standard features—only mirror technical advances and our own rising expectations.

Another comparison pits the Model 30 286 against IBM's Model 50 PS/2 Model 50. The two share the same microprocessor, clock and bus speed, hard disk, and performance. The only apparent difference is the future-oriented Micro Channel bus of the Model 50, compared with the backward compatibility of the AT bus Model 30 286.

The high-performance Micro Channel products that are finally entering the market will put that rumor to rest. The Model 30 286 is designed for compatibility with what you already have. The Model 50 looks to what you will be doing tomorrow. The Model 50, with its elaborate bus arbitration, expedited interrupt sharing, and expandable DMA is a vastly better multitasking engine. The Model 30 286 can run OS/2; the Model 50 is designed for OS/2.

That singular difference puts a broad gulf between the two systems. In effect, it bifurcates the IBM line of personal computers. On one side are the high-performance, multitasking engines equipped with the Micro Channel. On the other, single-tasking DOS-based machines anchored to the AT bus. In effect, IBM is cutting the singular personal computer market in two—one style of machine for power users and another for casual users.

The implication is that Micro Channel cannot be made cheaply. So far at least, the only computers to use the Micro Channel are, in fact, positioned at the high end of their product lines and the market. The AT bus, however, has proved itself cheap, as exemplified by the Blue Chips and Hyundais. The Model 30 286 emphasizes that distinction, particularly in comparison with the Model 50. Perhaps that's the entire purpose: to make non-Micro Channel



FACT FILE

IBM PS/2 Model 30 286

IBM Corp.

Consult your local authorized IBM dealer.

List Price: IBM PS/2 Model 30 286-E01 with 512K RAM and one 1.44MB 3 1/2-inch floppy disk drive, \$1,995; Model 30 286-E21 with 20MB hard disk, \$2,595.

In Short: Sporting an AT bus, this 10-MHz PS/2 is suited to non-power users who won't be bothered by the computer's mediocre hard-disk performance and limited expansion capacity, but who will appreciate its price.

CIRCLE 652 ON READER SERVICE CARD

computers appear more like second-rate cousins, boosting the prestige of IBM's better line.

Ignore the marketing issues, and the Model 30 286 could be classed as a neat little computer. It's just not a machine for power users. At its best it can serve as a desktop workstation for people who have a single purpose in mind, be it word processing, communications, or lightweight calculating (accounting instead of computer-aided engineering).

While its performance is hardly spectacular by today's 80386 standards, it's more than twice as fast as the original Model 30 and (ignoring its hard disk) will outrun any non-Micro Channel personal computer that IBM makes, including all those aging ATs.

Price is perhaps the single facet of the Model 30 286 that makes it most compelling. Its list tag—\$1,995 without hard disk and \$2,595 with—means that you should be able to bargain your dealer down to the dollars you'd spend on a typical clone, even within a few hundred dollars of most mail-order offerings. The extra bucks will buy you the security of knowing the manufacturer will be around a few years from now when the error messages start popping on your screen.

From that perspective, the Model 30 286 is a desirable computer for anyone who's neither power hungry nor in need of the promised multitasking offerings of the future.

Winn L. Rosch is a contributing editor of PC Magazine.

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■ PC LAB NOTES: COMMUNICATIONS ■ ROBERT L. HUMMEL AND RICHARD HALE SHAW

THE ASYNCHRONOUS ADAPTER AND RS-232

The serial port is an important part of PC communications. Here's a technical overview of the RS-232 port as well as instructions for building your own null-modem cable.

The advent of the PC brought real computing power to our desktops. Tremendous productivity gains were made using the four horsemen of application software: word processors, databases, spreadsheets, and communications. But while three of the four major applications are quite content to run in an isolated environment, communications implies talking to the world outside the PC.

When we talk in terms of communications on a PC, we're generally referring to a data exchange taking place through an asynchronous communications adapter. This adapter is known by many different but generally equivalent aliases such as the serial, asynchronous, and RS-232 port. We'll use the term asynchronous adapter when we mean the circuitry, and serial port when we mean the connector.

The asynchronous adapter is a vital link that enables your PC to exchange information with the outside world. In addition to a modem, this versatile interface can accommodate a large number of devices, such as mice, scanners, plotters, and printers.

Because the serial port has become standard equipment on PCs, it seems right to spend a little time discussing the adapter from the point of view most of us see it from: the connector. In addition to the descriptions of the pin assignments for both 25- and 9-pin serial cables, instructions for constructing your own null-modem cable are given in the accompanying diagrams. The null-modem cable is useful for connecting two PC serial ports directly, as is done when transferring files between a laptop and a desktop computer.

THE ASYNCHRONOUS ADAPTER

The asynchronous adapter is the circuitry that permits a PC to communicate with a serial device, such as a modem. In some PCs, the asynchronous circuitry is located

PRODUCTIVITY INDEX

PC LAB NOTES

An explanation of the RS-232 port, plus building a null-modem cable.

UTILITIES

BCOPY copies in the background, letting you proceed with your work.

ENVIRONMENTS

The flexibility of object-oriented vs. structured programming.

POWER PROGRAMMING

Here are the specifics of IBM's latest DOS version.

SPREADSHEET CLINIC

More uses for the F3 key; different symbols for graphs in Lotus 1-2-3.

USER-TO-USER

Catalog files on your floppy disk; create files of zero length.

POWER USER

Motion and color in dBASE programs; append records from dBASE files.

LANGUAGES

Expand DOS command parameters with C; new Turbo Pascal features.

PC TUTOR

Process DOS redirection commands; access the CLOCK\$ device driver.

CONNECTIVITY CLINIC

IMPORT.ASM shows off the file-transfer talents of NetBIOS.

on an expansion card plugged into the expansion bus. This board usually has a serial port connector mounted on the metal end-bracket of the board. To locate this connector, look for a D-shaped male connector that has either 25 or 9 pins. (A 9- or 15-pin female connector is a video output port, and a 25-pin female connector is a parallel printer port.) Newer PCs often include circuitry on the system board for 1 or 2 serial ports. Wherever it may reside, the asynchronous circuitry includes RAM and a small microcomputer whose responsibility is serial communications.

In the PC, the smallest unit used to represent data is the 8-bit character. The asynchronous adapter is responsible for taking the 8 bits of a character as input and breaking it down into a stream of serial bits. These bits are then transmitted out the serial port. When receiving data, the asynchronous adapter converts the serial bit stream back into parallel data.

The asynchronous adapter must perform a variety of tasks. It must, for example, monitor the flow of data from the PC to the serial device and implement the RS-232 protocol to ensure that the data transfer proceeds smoothly. It must also temporarily store, or buffer, the data and transfer it to the serial device or the PC when one of these signals that it's ready.

Serial communications involves more than simply the data bits. The asynchronous adapter prepares the data for transmission by adding stop, start, and parity bits to each character being transmitted. At the receiving end of a data transfer, it reads the data for receipt by the PC, stripping

■ PC LAB NOTES

away the extraneous bits and reassembling the characters received. In addition, the asynchronous adapter must detect and ignore false start bits. It checks the received characters against their parity bits, and notifies the communications software in the event of a parity error. Finally, it provides a means for application software to control data transfer speeds.

THE RS-232 INTERFACE RS-232 is a specification developed in 1969 by the Electronic Industries Association (EIA).

This specification is a standard that defines the electrical characteristics for interfacing data terminal equipment (DTE) such as PCs to data communications equipment (DCE) such as modems.

In the context of PCs, the phrase RS-232-compatible usually refers to the use of a DB-25 or DB-9 connector on the serial port of your PC's asynchronous adapter. Simply using a conventional connector, however, does not guarantee or imply that all signals defined by the RS-232 standard are supported by the device.

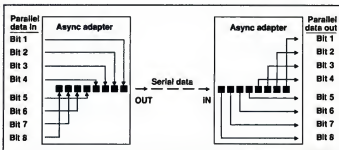
This usually is not a problem when you are connecting an industry-standard asynchronous adapter to an industry-standard modem. But you should be cautious when you use a generic serial extension cable (with a male connector on one end and a female connector on the other end). Most of these cables do not connect to all 25 pins on both sides of the cable, and some join as few as 3. If your modem, printer, or mouse doesn't appear to work, it may be expecting to see a signal on a pin that's not connected.



Parallel-to-Serial Conversion

The role played by the PC's Asynchronous Communications Adapter is really a simple one. A character is transmitted to the async adapter by the PC: inside the PC, all 8 bits move at the same time (parallel data transfer) and are captured, or latched, by the adapter. These 8 bits are then transmitted one at a time by the async adapter. The parallel data is converted to a serial stream of bits.

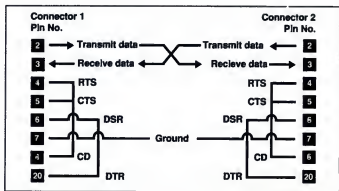
At the receiving end, another async adapter can reconstruct the character by performing the same function in reverse. Serial data is converted back to parallel data and made available to the PC.



The Null-Modem Cable

The null-modem cable is simply two DB-25 connectors joined by a length of cable. It eliminates the need for a modem when connecting two computers directly. The wires for pins 2 and 3 are reversed from one connector to another. This allows each computer to send data on what it sees as pin 2 and receive data on what it sees as pin 3.

Pin 7 (the ground) is wired directly from computer to computer. Pins 4, 5, and 8 (Request to send, Clear to send, Carrier detect) are wired together at each end, as are pins 6 and 20 (Data set ready and Data terminal ready). With these minor wiring arrangements, two PCs can communicate directly without a modem.





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■ PC LAB NOTES



Constructing a Null-Modem Cable

Determine the desired length of the cable, then add about 6 inches. (The maximum length for an RS-232 cable is about 25 feet.) Cut the cable. Prepare the wire by carefully removing 2 inches of the plastic outer sheath from the cable. Don't cut the shield, but peel it back out of the way. From the end of each wire, strip approximately 1/4-inch of insulation. Be careful not to nick the wire itself. When all the wires have been prepared, move to the next step.

Before making each connection, slip a short length of heat-shrink tubing (slightly larger in diameter than the base of the pin) over each wire and push it up out of the way. Place the wire in the solder cup of the pin and heat the joint from below with the soldering pencil. Apply the solder from the top and let it flow over the joint. Remove the soldering pencil and hold the wire and connector still until the solder sets (4 to 5 seconds).

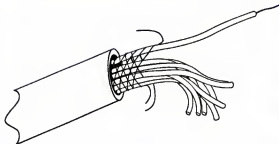
When connecting pin 7, attach an extra length of small wire from the shield to the pin. This will ground the shield and help reduce stray fields radiated or picked up by the cable.

Warning! When soldering the first connector, it's not important what wire goes to which pin. This isn't true for the second connector. Use an ohmmeter or continuity checker to identify each wire and connect it to the appropriate pin, as shown in the null-modem schematic.

(Note: The construction of pins can vary greatly among manufacturers, so adjust your soldering technique accordingly.)

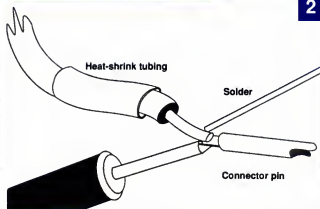
Preparing the Wire

1



Soldering the Wires

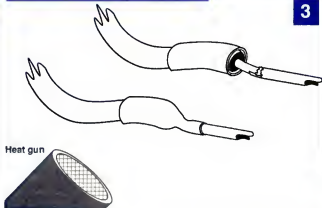
2



Check for solder bridges or blobs between pins. If you find any, pick them out with a sharp instrument or small knife. To make the connector neat and reduce the chance of a short circuit, which would interfere with communications, slide the heat-shrink tubing down over each pin and treat with a heat gun. (If you don't have a heat gun, you can hold the soldering iron below—not touching—the tubing.) Make sure all tubing is in place before applying any heat.

Insulating the Pins

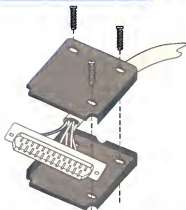
3



Finally, attach the connector body. Again, styles of manufacture differ, but the principle is the same. Tighten all screws, and you're ready to go.

Assembling the Shell

4



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than Rome
and more
boulevards
than Paris!
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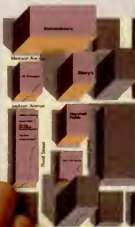
LET'S SEE, KANSAS CITY. NEW ORLEANS MEANS JAZZ AND NEW YORK MEANS SHOPPING. SEATTLE MEANS RAIN AND MOUNTAINS. When you're in the city for these things, there are other things, interest. It may surprise you to learn that Kansas City is all these things and more. With more fountains than Rome and more boulevards than Paris, this city is one of America's understated travel destinations. From the simplicity to the Chert's gate, from gleaming shopping plazas to modest business centers, from art galleries to jazz nightclubs, Kansas City is a city of contrasts. The city has clearly earned its nickname, "The Heart of America."

ARCHITECTURE A visitor to Kansas City can't help but be struck by the contrast between old and new, with the bustling boom of the last few years meeting steel skyscrapers next to century-old storefronts. But looking beyond the skyline, you'll find the city's architectural heritage of 150 years of vibrant growth. The highlights, especially for history buffs, is KawScape, a beautifully restored building that was a major meeting center for southwest travelers in the 1850s. Also of special interest is Country Club Plaza. Built in the 1920s and famous as the nation's first shopping center, it's a wonderful sight in the middle of a large metropolitan city, a collection of neoclassical buildings modeled after those in Seville, Spain. The famous

The area's historic sample of late 19th-century life is run on, here, there is some 10 miles from downtown, but with the city. It is in Independence, and it is the former home of President Harry S. Truman. Now under the ownership of the National Park Service, the house is open to the public. And while you're in Independence, stop in the Truman Library for a look at the huge mural by Thomas Hart Benton in the lobby entitled "Independence and the Signing of the War."



SHOPPING The star of Kansas City shopping is the Crown Center, an 85-acre "city within a city" built by Hallmark Cards. Crown Center offers 90 shops, department stores, and restaurants of every



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Financial Report To Division Managers

The first quarter numbers are in . . .

	Three Months Ending		Six Months Ending	
	MARCH 31, 1988	MARCH 31, 1987	MARCH 31, 1988	MARCH 31, 1987
SALES				
U.S.	4,607,270	1,223,536	8,766,950	2,165,070
Europe	3,726,216	978,510	7,013,520	1,786,076
Asia	931,593	244,627	1,793,381	437,014
Net Sales	9,315,139	2,446,273	17,533,808	4,378,140
OPERATING EXPENSES				
Cost of sales	2,081,261	201,035	3,823,581	563,980
Selling, general, and administrative	2,664,439	671,306	6,959,663	1,480,362
Research and development	663,465	164,153	896,671	262,961
Income from operations	3,327,644	1,225,313	5,853,865	2,052,967
Equity in loss of K.C. operations	(156,915)	-	(218,114)	-
Interest income	73,473	53,878	108,171	62,413
Income before federal income taxes	3,074,402	1,279,091	5,743,902	2,115,320
Provision for federal income taxes	1,139,000	511,000	2,179,000	911,000
Net income	1,935,402	767,991	3,564,902	1,204,320
Net income per share of common stock	\$0.17	\$0.06	\$0.31	\$0.11

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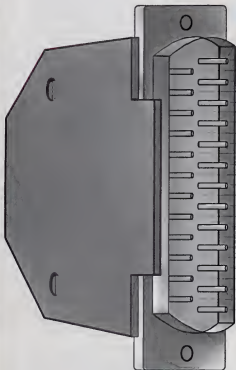
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■ PC LAB NOTES



RS-232 Connector Pin Assignments



The DB-25 Connector

Pin No.	Name	Direction	
		To PC	To modem
1	Protective ground		•
14	Secondary transmitted data		•
2	Transmit data		•
15	Transmit clock	•	
3	Receive data	•	
16	Secondary received data	•	
4	Request to send		•
17	Receiver clock	•	
5	Clear to send	•	
18	Unassigned		
6	Data set ready	•	
19	Secondary request to send		•
7	Signal ground		
20	Data terminal ready		•
8	Carrier detect	•	
21	Signal quality detect	•	
9	Reserved for test		
22	Ring indicate	•	
10	Reserved for test		
23	Data signal rate select		•
11	Unassigned		
24	Transmit clock		•
12	Secondary carrier detect	•	
25	Unassigned		
13	Secondary clear to send	•	

Transmit data (TD)

Carries data from the PC to the modem.

Receive data (RD)

Carries data from the modem to the PC.

Request to send (RTS)

Used to request clearance to send data to modem. Used in conjunction with CTS to control the flow of data from a PC to a modem.

Clear to send (CTS)

Used by the modem to acknowledge the PC's RTS signal and indicate that it is ready to receive data.

Data set ready (DSR)

Used by the modem to signal that it is connected to a telephone line and in data transmission mode. Used by an auto-dial modem to signal that it has successfully dialed a remote computer.

The RS-232 standard assigns a function to each pin of the DB-25 connector. This commonplace connector is found on RS-232 cables, serial port adapters, and modems. It was used by IBM for the PC, PC-XT, and members of the PS/2 series. The PC AT departed from tradition and used the DB-9 connector to save space on the end plate of expansion cards.

Many of the functions assigned to pins by the RS-232 standard support protocols that are not normally used on PCs. The essential pins required for PC communications include pins 2 through 7 and pin 20. In addition, the IBM serial port requires pin 8, and some communications software packages require pin 22.

An entry in the Direction column indicates whether the signal on a particular pin is sent to the PC from the modem, or the reverse.



The DB-9 Connector

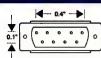
Pin No.	Name	Direction	
		To PC	To Modem
1	Carrier detect	●	
6	Data set ready	●	
2	Receive data	●	
7	Request to send		●
3	Transmit data		●
8	Clear to send	●	
4	Data terminal ready		●
9	Ring indicator	●	
5	Signal ground		

The DB-9 connector was used to save space on the end plate of expansion cards. Since the smaller connector carries all the signals needed for PC-based communications, using the DB-9 allows two serial port connectors to fit on a single end plate without sacrificing functionality. The DB-9 for serial ports was introduced by IBM with the PC AT. The pins included are a subset of the DB-25: pins 2 through 8, 20, and 22.

DB-25 Connector: Pin Spacing



DB-9 Connector: Pin Spacing



Carrier detect (CD)

Used by the modem to signal that a carrier signal has been received from a remote modem. The CD light on the front of a modem is lit when this signal is sent.

Data terminal ready (DTR)

Used by the PC to signal that it is ready to communicate with the modem.

Ring Indicate (RI)

Used by an auto-answer modem to signal the receipt of a telephone ring signal.

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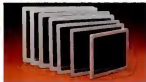
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Event-Trapping Statements

ON KEY(n) — Enable function- or Ctrl-key trapping

SYNTAX: ON KEY(n) GOSUB *subline*

n = numeric expression 1..20

- 1..10 Function key F1..F10
- 11 Up Arrow
- 12 Left Arrow
- 13 Right Arrow
- 14 Down Arrow
- 15..20 Keys defined by KEY *m*[(CHR\$(KBtag) + CHR\$(scancode))]

ON PEN — Enable light-pen trapping

SYNTAX: ON PEN GOSUB *subline*

ON PLAY(n) — Play continuous background music

SYNTAX: ON PLAY(n) GOSUB *subline*

n = 1..32. Branch when *n* notes remain in play buffer.

ON STRIG(n) — Trap on joystick triggers

SYNTAX: ON STRIG(n) GOSUB *subline*

ON TIMER — Trap on specified time

SYNTAX: ON TIMER(n) GOSUB *subline*

PEN — Set up trapping on use of light pen

SYNTAX: PEN ON/OFF/STOP

RESUME — Continue program after error recovery

SYNTAX: RESUME [0] — or — RESUME NEXT — or —

RESUME *line*

RESUME or RESUME 0 resumes at statement that caused error.

RESUME NEXT resumes at following statement.

RESUME *line* resumes at specified line.

STRIG — Set up trapping on joystick buttons

SYNTAX: STRIG ON/OFF

STRIG(n) — Enable/disable specific joystick buttons

SYNTAX: STRIG(n) ON/OFF/STOP

n = 0, 2, 4, or 6, corresponding to buttons A1, B1, A2, and B2, respectively.

System-Level Statements

DATES — Set the system date

SYNTAX: DATES = *stringvar*

stringvar = new system date. Must be in one of four forms: "mm-dd-yy", "mm/dd/yy", "mm-dd-yyyy", "mm/dd/yyyy". Year must be from 1980 to 2099.

ENVIRON — Modify BASIC's environment

SYNTAX: ENVIRON *parm* = *envstring*

parm = name of a parameter, for example, PATH

envstring = new value for parameter

NOTE: If *envstring* is null or consists of only a semicolon, the parameter is removed from the environment.

IOCTL — Send a control string to an open device

SYNTAX: IOCTL [#]*filenum*, *string*

string = string expression containing control data

MOTOR — Turn cassette motor on and off

SYNTAX: MOTOR [*state*]

state = if nonzero, turn on motor. If zero, turn off. If omitted, switch to opposite state.

OUT — Send a byte to a port

SYNTAX: OUT *portnum*, *byte*

portnum = number of port, 0..65535

byte = byte to send, 0..255

PLAY — Interpret string of PLAY commands

SYNTAX: PLAY *string*

NOTE: PLAY interprets the string argument as a line of tune definition language. The language consists of the following commands:

- A-G Play this note in current octave.
- + Make preceding note sharp.
- # Make preceding note sharp.
- Make preceding note flat.
- O Set octave (0..6). Default 4.
- > c Raise octave and play note c.
- < c Lower octave and play note c.
- N n Play note n (0..84). 7 octaves of 12 notes make 1..84, and 0 = rest.
- L n Set length of following notes to 1/n (1..64). Quarter note = 4.
- P n Play a rest of length 1/n (as for L, n).
- . Period makes preceding note 1.5 times as long.
- T n Set tempo to *n* quarter notes per minute (32..255). Default 120.
- MF Music foreground. Default.
- MB Music background. Program continues execution while music plays up to 32 notes.
- MN Music normal. Notes play 7/8 of length, silent 1/8.
- ML Music legato. Notes play full length.
- MS Music staccato. Notes play 3/4 of length, silent 1/4.
- X *string*. Execute substring. Allows a PLAY statement to execute a second string.

NOTE: The *n* arguments can be replaced by numeric variables by putting an equals sign before the variable name and a semicolon after. In compiled BASIC you must use the VARPTR(*variable*) form for any variables.

POKE — Write a byte to memory

SYNTAX: POKE *offset*, *byte*

byte = 0..255

SHELL — Load and execute a program

SYNTAX: SHELL [*command string*]

NOTE: If not *command string*, you load secondary command processor (and with EXIT). If *command string*, BASIC passes the command to secondary processor with /C switch.

SOUND — Make sound on speaker

SYNTAX: SOUND *freq*, *duration*

freq = frequency in cycles per second, 37..32767.

Use 32767 for no sound.

duration = time in clock ticks (18.2 per second).

0.0015 to 65535

TIMES — Set system time

SYNTAX: TIMES = *string*

string = new system time string of form "hh" or "hh:mm" or "hh:mm:ss"

WAIT — Suspend program waiting for input port status

SYNTAX: WAIT *portnum*, *n* [, *m*]

portnum = 0..65535

n = 0..255

m = 0..255. Default 0.

NOTE: BASIC repeatedly reads the port and calculates the byte read XOR *m* AND *n*, until the result of this calculation is nonzero.

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■ PC LAB NOTES

RS-232 PIN ASSIGNMENTS The key to working with the RS-232 standard on PCs is the assignment of the pins on the DB-25 connector. Most modems have a female serial connector, and male versions are found on most PC asynchronous adapters. This requires the DB-25 cable to have a female and a male version of the RS-232 connector.

The IBM PC, PC-XT, PS/2s, and some expansion boards use the DB-25 connector. The PC AT and the remainder of expansion boards use a smaller version of the DB-25 called the DB-9. Since the AT serial port is usually a male connector, the connecting cable requires a female DB-9 at one end and a male DB-25 at the other end to connect with the modem. To match the DB-9 connector to the more common DB-25 connector, a small, 9-pin-to-25-pin converter cable is often used.

The essential seven signal pins of a DB-25 connector are pins 2 through 7 and pin 20. The IBM PC and AT serial ports require pin 8 to be connected, and some communications software uses pin 22. Note that the AT's DB-9 connector has pins that correspond functionally with the essential DB-25 pins, but they are numbered differently. The PC expects to send its data on pin 2 and receive it on pin 3. Conversely, the modem expects to receive data from the PC on pin 2 and send data to the PC on pin 3.

THE NULL-MODEM CABLE The null-modem cable is actually a modem eliminator—a cable designed to connect the serial ports of two PCs to each other without the need for a modem. As mentioned, the serial port on a PC's asynchronous adapter expects to send data on pin 2 and receive it on pin 3. By crossing the wires from pins 2 and 3 between the connectors, each PC will be able to send data on pin 2, which will be received by its counterpart on pin 3. Thus, each PC "thinks" that it's communicating with a modem when in fact the signals are going directly into the serial port of another PC.

CONCLUSION The serial port and the RS-232 standard are important in the operation of your computer. While you don't have to be an expert, getting to know them a little better can help you troubleshoot

problems before they become roadblocks to productivity. Keep this PC Lab Notes handy for future reference about the asynchronous adapter, and watch for an upcoming utility that makes use of a null-mo-

dem cable for PC-to-PC file transfers. ☐

Robert L. Hummel is senior technical editor of PC Magazine. Richard Hale Shaw is a contributing editor of PC Magazine.

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Patience and productivity don't mix. Just sitting there fuming while a long AUTOEXEC.BAT copies your most-used program files to a RAMdisk is a bad way to start the day. Put BCOPY in that AUTOEXEC.BAT file, however, and you will be out of the blocks like a 100-meter sprinter.

The idea for BCOPY actually came from one of Charles Petzold's Environments columns, in which an OS/2 command was used to copy files to a RAMdisk as a background task during the execution of AUTOEXEC.BAT.

BCOPY can be used for the same purpose. Just as the DOS PRINT command lets you print files in the background, BCOPY copies files in the background, so you can do your work while it does its job. As icing on the cake, you can even instruct BCOPY to remove itself from memory after it has finished doing its job, thus avoiding RAM cram.

You can download a ready-to-run copy of BCOPY.COM from PC MagNet, as explained in the sidebar "BCOPY by Modern." Alternatively, if you're sharp of eye and careful of finger, you can type in the BCOPY.ASM source code printed here. Then assemble, link, and EXE2BIN it, as shown in the accompanying DOS Manual Page.

Or, if you don't have either an assembler or a modem, you can type in BCOPY.BAS, a BASIC program that will automatically generate the BCOPY.COM file. Both the BCOPY.ASM and BCOPY.BAS programs are also downloadable from PC MagNet.

USING BCOPY With minor exceptions, you use the same syntax for BCOPY as for the DOS COPY command:

```
[d:]([path])BCOPY [source] [target] [/X] [/U]
```

Since BCOPY is not an internal DOS command, if you don't keep it on a drive and directory listed in your PATH statement, you will have to tell DOS where to find it. The *source* and *target* may stand for either filenames or directories, though if the *source* is a directory, BCOPY will not automatically supply an implicit *. * when copying all files from one directory to another. The DOS wildcard characters (* and ?) are supported, and *source* and *target* may also include a drive and path, just as with COPY. The difference BCOPY makes becomes clear when you press the Enter key. With BCOPY, the cursor reappears immediately. You can go about other tasks while BCOPY copies the files quietly in the background.

■ BCOPY provides a good programming example of how to combine file operations with a terminate-and-stay-resident utility.

There are a few differences between the syntax for COPY and BCOPY. First, BCOPY does not support concatenating multiple files into a single file by using the plus sign. Second, BCOPY always performs a straight binary copy of the file; it does not recognize the Ctrl-Z character as an end-of-file character. And third, unlike COPY, BCOPY won't send you a "Target disk full" message. For backup purposes you'd probably use another utility anyway, however, so this won't affect the normal use of BCOPY.

Although BCOPY doesn't use COPY's /A and /B command-line switches, it has two switches of its own. If you include the /X switch the first time the program is called, BCOPY will use one page of expanded memory as a data buffer. Using expanded memory—assuming you have it—saves 4K of conventional RAM. If BCOPY has already been installed, the /X command is ignored.

The /U command tells BCOPY to remove itself from memory after it has completed all the copies currently listed in its queue. The program is smart enough not to uninstall before all the requested copies have been made. You don't have to give BCOPY any work to do in order for the /U command to work. If no files are specified, BCOPY prints a message telling you it can't find the files specified, but it still removes itself from memory.

HOW BCOPY WORKS BCOPY provides a good programming example of how to combine file operations with a terminate-and-stay-resident utility. To per-

■ UTILITIES

form a simple copy, BCOPY must open, read, write, and close files. The trick, however, is that BCOPY must perform these functions in the background.

There are three parts to BCOPY: the resident code, the nonresident code, and the data buffer. The nonresident code executes each time BCOPY is called from the command line. The resident code does the actual file copying. The data buffer is used both to save the names of the files to be copied and as a buffer to hold data between the time the files are read and written.

Since a user—or a batch file—can call BCOPY faster than the program can copy files, a queue is needed to hold the names of files to be copied. This queue is formed by a linked list of entries, the structure of which is shown in Figure 1. Each entry specifies the source and destination filenames, along with flags that indicate the status of the copy and a pointer to the next entry in the queue. The last pointer is loaded with 0FFFFh to indicate it is the last entry in the queue. The boundary between the queue and the data area is determined by a pointer to the start of the data area.

THE NONRESIDENT CODE The nonresident code is in charge of scanning for command-line switches, parsing the filenames in the queue that is to be copied, and also installing the background portion

of BCOPY, if it is necessary.

As with most utilities, BCOPY first performs certain standard TSR housekeeping functions. These functions include determining the DOS version, getting the default disk drive, and determining if the resident part of BCOPY is already in memory. Note that unlike many TSRs, however, BCOPY will install itself only if you give it some work to do. If you initially enter BCOPY without any files to copy, it returns a syntax message but does not install itself. If BCOPY finds a copy of itself resident, it saves the segment of the installed code so the names of the files can be copied to the resident section.

Next, BCOPY scans the command line for command-line switches. It looks for the slash (/) character and returns the character immediately following. BCOPY checks for two switches, /X for expanded memory and /U for uninstall. The scanning routine does nothing but set flags that are acted on by a later part of the code.

Parsing filenames is one of BCOPY's more complex functions. The parsing code generates an ASCII string that fully specifies the disk, directory, and filename for both source and destination filenames. These strings are used with the DOS file commands. BCOPY must specify each filename completely because the resident part of the code is simply not able to as-

sume any default drive or path.

The actual parsing is done by checking for key characters in the filenames supplied on the command line. For example, to check to see if a disk drive has been specified, BCOPY checks to see if the second character in the filename is a colon. If so, the first character is assumed to be a

■ Since a user—or a batch file—can call BCOPY faster than the program can copy files, a queue is needed to hold the names of files to be copied.

disk specification. If not, the current default drive is supplied.

After determining the disk, the next character in the filename is then compared with the backslash to see whether the user has specified the filename from the root directory. If not, the DOS Get Path function is used to copy the current path for the disk specified into the filename. Finally, the remainder of the filename is copied to the parsed filename string. As each character is copied, it is capitalized, as this uniformity will be needed when the source and destination strings are compared.

When copying the rest of the filename, BCOPY makes an additional check for consecutive periods. This accommodates the convention by which DOS allows users to back up by one directory when giving a file specification. If a double period is found, BCOPY scans the ASCII string backwards until it finds the previous backslash. It then continues to copy the remainder of the filename over the previous directory—effectively backing up one directory itself. The remainder of the filename is then copied to complete the ASCII string. Just as with COPY, wildcard characters are allowed in the source file specification. Thus each filename can specify

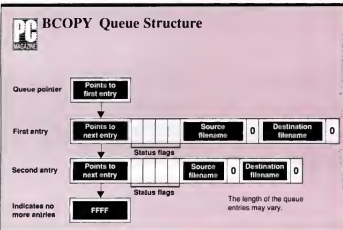


Figure 1: The BCOPY queue structure uses a linked list to accommodate many items of various sizes. Each entry specifies the source and destination filenames, plus status flags and pointers.

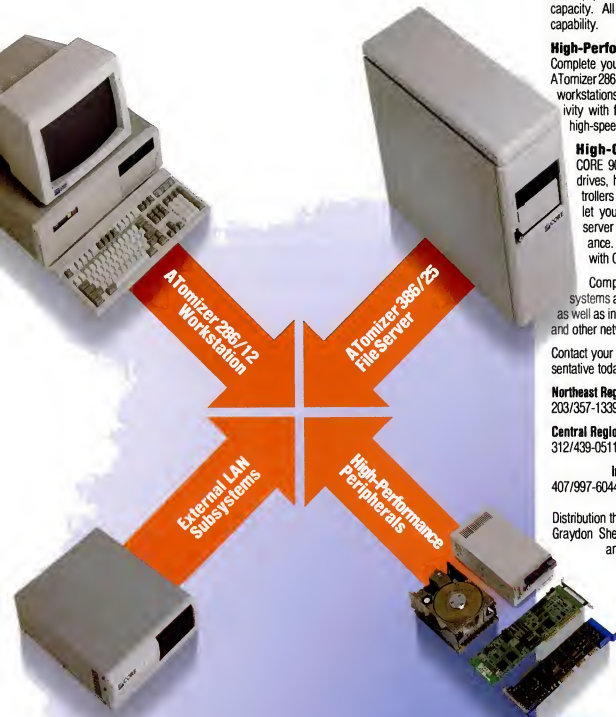
PRODUCTIVITY

discussions

BCOPY.ASM: The assembly language source code for **BCOPY.COM**, a utility that lets you copy files in the background while you continue your other activities. You can even instruct **BCOPY** to remove itself from memory after it is finished copying the files.

(BCOPY ASM continues)

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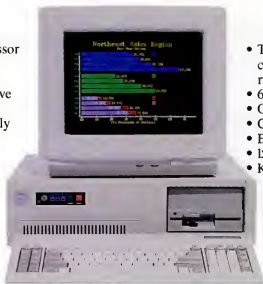
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```

; REMOVE deallocates the memory block addressed by AX and restores the
; interrupt vector displayed on installation.
; Entry: DS - segment to release
; Exit:  CF clear = program installation
;        CF set  = can't install
REMOVE    PROC    REAR
          ASSUME  CS:CODE
          JNC     CS:ACTIVE
          CALL    SAVE_REGS
          ASSUME  DS:CODE
          ; save registers

; make sure none of the vectors have been altered.

          MOV     AX,0
          CALL    CHECKVECTOR
          JNE     REMOVE_ERROR
          MOV     AX,13h
          CALL    CHECKVECTOR
          JNE     REMOVE_ERROR
          MOV     AX,20h
          CALL    CHECKVECTOR
          JNE     REMOVE_ERROR

; if using EAX memory, release it.
          CWP     DS,FLAG,0
          JE      REIP_REMOVE_End
          MOV     AX,47h
          INT     21h
          ; deallocate pages
          MOV     DS,END_HANDLE
          INT     27h
          MOV     AX,AX
          JNE     REMOVE_ERROR
REIP_REMOVE_End

; release the memory occupied by the program.
          PUSH    CS
          POP     AX
          MOV     AX,47h
          INT     21h
          ; free memory given to
          ; original program block
          JC      REMOVE_ERROR

; restore the interrupt 9, 13h, and 20h vectors.
          PUSH    DS
          MOV     DS,DS:[OFFSET DS]
          MOV     AX,2100h
          INT     13h
          ; restore interrupt 9 vector
          MOV     AX,2510h
          INT     13h
          ; restore interrupt 13h vector
          MOV     AX,2520h
          INT     21h
          ; restore interrupt 20h vector
          MOV     AX,2530h
          INT     13h
          ; restore interrupt 20h vector
          MOV     AX,2540h
          INT     21h
          POP     DS
          MOV     DS,DS
          ; restore DS

; destroy the ASCII fingerprint that identifies the code and salt.
          INC     WORD PTR [DSI]
          CJC     DESTROY_FINGERPRINT
          ; destroy fingerprint
          ; clear CF for salt
REMOVE_ERROR:  DEC     BYTE PTR [DSI]
              CALL    DESTROY_FINGERPRINT
              RET
              ; exit with CF intact

; the program can't be uninstalled. set CF and exit.
REMOVE_ERROR:  STC
              JMP     REMOVE_EXIT
REMOVE        ENDP

CHECKVECTOR    PROC
; CHECKVECTOR is called by REMOVE to compare the segment pointed to by AX
; interrupt vector against the value supplied by the caller.
; Entry:  AX - interrupt number
; Exit:  BP clear = segment does not match
;        BP set  = segment match
CHECKVECTOR    PROC    REAR
          PUSH    CS
          PUSH    DS
          MOV     AX,35h
          INT     21h
          ; get vector
          MOV     AX,25
          INT     21h
          ; transfer segment to AX
          JCMP    AX,C2
          ; compare
CHECKVECTOR    ENDP

;-----
; FINALINSTALL is called during the data phase and to TSM.
;-----
FINALINSTALL   PROC
          ASSUME  CS:CODE,DS:CODE
          MOV     DS,DS:[OFFSET DS+PTR]
          MOV     DS,DATA_ADDRESS
          MOV     DS,OFFSET END_OF_CODE
          CALL    GET_FILE_NAME
          MOV     DATA_BUFFER_OFFSET,DS
          INC     FILE_COUNT
          ; set start of data buffer
          ; file count

; terminate and remain resident in memory.
          DEC     ACTIVE
          MOV     AX,2100h
          ; allow background task
          ; terminate with ERRORLEVEL = 4
          MOV     DS,OFFSET END_OF_DATA+OFFSET CODE*13
          CWP     DS,FLAG,0
          JE      FINAL_INSTALL
          MOV     DS,OFFSET DATA_BUFFER+OFFSET CODE*13
          ; run 4
FINAL_INSTALL:  INT     21h
              ENDP

```

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2001

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tries to tell
you that one
language
fits all, turn
the page.

To each



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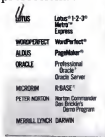


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■ UTILITIES

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LOOKS
CWP      AC, " "
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CWP      AL, " "
JLE      SCANSOURCEP1
CWP      AL, " "
JLE      SCANSOURCEP1
CWP      AC, " "
JLE      SCANSOURCEP1
CWP      AC, "A"      SCANSOURCEP_END
JH      SCANSOURCEP_END
CWP      AL, " "
JLE      SCANSOURCEP_END
AND      AL, 0xFFH
SCANSOURCEP_END:
JLC      RET
JLE      RET
SCANSOURCEP1:
BTC      RET
JNE      SCANSOURCEP
SCANSOURCEP      =      $
END_OF_CODE
CODE      END      BR000P

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918	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
919	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
920	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
921	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
922	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
923	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
924	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
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929	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
930	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
931	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
932	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
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937	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
938	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
939	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
940	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
941	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
942	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
943	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
944	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
945	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
946	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
947	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
948	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
949	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
950	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
951	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8
952	DATA	PF	44	3	56	3	26	86	3	82	67	3	33	34	8	8</

307

■ UTILITIES

multiple files without using more than one entry in the queue.

The destination filename must be treated somewhat differently from the source. As with COPY, the destination filename is optional. If any part of the destination path is not specified, BCOPY creates a path assuming the current disk and directory as the default. If the filename is not specified, the source filename is used for the destination.

After the filenames are parsed, BCOPY uses the DOS Find First function to verify that the source filename is valid. If not, BCOPY prints an error message and terminates. If the source is valid, BCOPY checks the destination filename.

Just how to determine whether the user has specified a destination file or just a directory is an interesting problem. BCOPY assumes that the user has specified only the directory and tries to switch the default directory to the destination name. If no error code is returned, then the destination must be a directory. If an error is returned, BCOPY attempts to find the file using the same Find First function used for the source filename. If DOS indicates that the path is invalid, then BCOPY will assume

two strings is not good enough, however, since the destination string may specify only the directory. Therefore, BCOPY first compares the paths of the two file specifications. If the paths are the same and if the destination filename is not specified, then the file specifications are assumed to be the same and BCOPY will reject the copy request.

Only after the filenames have been parsed does BCOPY check whether it has already been installed. If not, it remedies this situation, going through the standard litany of retrieving pointers to the INDOS and critical error flags, computing memory requirements, and initializing an EMS memory page, if requested.

BCOPY uses three interrupts to hook into DOS: the timer interrupt (08h), the BIOS disk interrupt (13h), and the DOS IDLE interrupt (28h). Using so few interrupts helps keep BCOPY as compatible as possible with the myriad of programs currently written for the PC. Using few interrupts is also desirable in a utility that may need to be removed from memory, since if the interrupts are subsequently altered the program cannot be uninstalled.

In most TSR utilities, installing the resident code is the last function performed before terminating. Before returning to DOS, however, BCOPY must transfer the source and destination filenames into the background queue. To do this, the end of the queue is found by jumping through each entry's pointers until the last one is found. A new entry is then created, and the pointer in the previous entry is updated so it points to this terminal entry, whose own pointer is loaded with 0FFFFh. The pointer separating the queue from the data area is updated to point to the byte beyond the last entry in the queue. These relationships are diagrammed in the BCOPY Memory Allocation Map shown in Figure 2.

Coordination between the resident and nonresident code sections presents a problem about which whole books have been written. You can see the difficulty by noting that there is always a chance that when BCOPY attempts to update its queue, the resident code will itself become active. In such an event, the resident portion would read only a partially written queue. BCOPY handles this problem by disabling the resident code any time BCOPY is exe-

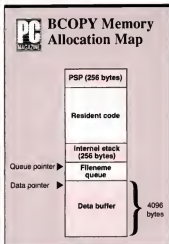


Figure 2: The memory occupied by BCOPY is allocated according to use. Once resident, all sizes are fixed.

cuted from the command line.

The nonresident code disables the resident code by incrementing the ACTIVE flag. The resident code checks this flag to determine whether it can take control. If zero, the resident code knows it is clear to activate. The resident code increments this flag each time it becomes active. The nonresident part of the code also checks the flag, which is set and cleared so that neither part of the code can activate while the other is currently active.

THE RESIDENT CODE The resident code is the part of BCOPY that does the actual copying. Each time it activates, it first checks that no disk operations are currently active and that DOS, if active, is running only one of the minor I/O functions. Since the ins and outs of when to activate resident utilities have been discussed at length in previous *PC Magazine* columns, I needn't discuss them further here.

The resident code must go about its business quietly—that is, without disrupting anything. To achieve this, BCOPY uses every trick in the book to save the current context of DOS each time it is activated. Fortunately, the later versions of DOS have made this task much easier.

■ Using only three interrupts helps keep BCOPY as compatible as possible with the myriad of programs for the PC.

that the user has specified an illegal destination path.

If DOS indicates that the file could not be found, BCOPY then assumes that the user has specified a correct filename that does not already exist. To indicate to the resident code that the destination specification is only a directory, the verification routine appends a trailing backslash to the destination filename.

Next, the two filenames are compared to ensure that the user is not trying to copy a file onto itself. Simply comparing the



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BCOPY.COM Command

Douglas Boling

1989 No. 1 (Utilities)

Purpose:

A memory-resident utility that copies files in the background so the user does not have to wait until the copying is completed before continuing his work.

Format:

```
[d:] [path]BCOPY [source [target]] [/X]/[U]
```

Remarks:

The *source* and *target* parameters have the same usage in BCOPY as in the DOS COPY command, save that if the *source* is a directory, BCOPY will not automatically assume an implicit *. DOS wildcard characters (*) and (?) are supported, however, and a *source* filename need not be repeated as part of the *target* filespec unless the name is to be changed. If initially run with the /X command-line switch, BCOPY will use one page of Expanded memory for its data buffer, thus saving 4K of conventional RAM. Run with the /U switch, BCOPY will uninstall itself from memory, if possible. BCOPY will always complete all copying tasks in its queue before uninstallation.

BCOPY does not support the DOS COPY /A and /B switches: it makes straight binary file copies and does not stop at a Ctrl-Z end-of-file marker. Nor does BCOPY allow using the plus (+) sign to combine multiple source files into a single copy. Note: unlike the DOS COPY command, BCOPY does not return a Target Disk Full error message, so care must be exercised to ensure that adequate storage space is available. Since the principal use of BCOPY is to load files to a RAMdisk during the execution of an AUTOEXEC or other batch file, however, this should not present a problem in normal use.

Available for downloading from PC MagNet (see the "BCOPY by Modem" sidebar), BCOPY.COM is already compiled and ready to run. BCOPY.BAS will automatically create BCOPY.COM when run once in BASIC. Creating BCOPY.COM from the BCOPY.ASM source code requires use of a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASH BCOPY;
LINK BCOPY;
EXEBIN2 BCOPY BCOPY.COM;
```


■ UTILITIES

First, as any utility should do, BCOPY sets the stack pointer to its own internal stack. Pointers to the current PSP and disk transfer area are saved, and DOS is redirected to the resident code now in control. The Ctrl-C and Ctrl-Break interrupts are disabled, and the critical error interrupt is redirected to an internal routine. If BCOPY runs under DOS 3.x or later, the critical error information is also saved.

Once the current context has been saved, the resident code can operate like any other program that uses the DOS file commands. Flags in the current queue entry are examined to see if the copy has been started. If not, the source file is opened and the destination file is created. Using the DOS Create function ensures that any destination file that existed before is deleted, saving BCOPY the trouble. The flags also indicate if BCOPY should use a Find First or a Find Next search when looking for the source file. This is necessary because the file specification may contain wildcards

that specify more than one file.

Since the background task can operate at any time, there is no guarantee that there will be enough free handles for BCOPY to open the files. If no handles are available,

■ **Using DOS Create**
ensures that any destination file that existed before is deleted, saving BCOPY the trouble.

BCOPY simply terminates and waits for one to become free. Once opened, BCOPY does not close the files until the copy is completed.

One of the trade-offs involved in de-

signing a program like BCOPY is determining the amount of time the resident code should spend in control of the machine. If BCOPY takes too much time from DOS, you notice the computer slows down. Conversely, if BCOPY is given too few time slices, the file takes too long to copy. As written, BCOPY's resident code activates every second or—if DOS calls its idle interrupt—as quickly as 1/2 second. Since the resident code spends most of its time reading and writing to the disk, the amount of data transferred at one time is limited. BCOPY transfers up to 4K of data each time the resident code is activated.

BCOPY must be able to respond to any errors DOS returns during disk operations. For this reason, BCOPY intercepts the DOS critical error interrupt each time its resident code activates. DOS has always given the user three options when an error occurs—the familiar Abort, Retry, and Ignore. The less-known Fail option was added in DOS 3.0.

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When running under DOS 3.0 or later, BCOPY's error-handling routine tells DOS to Fail the current function call. This option instructs DOS to stop the current operation and return to the calling function with the carry flag set. If using a DOS version earlier than 3.0, BCOPY picks the Retry option.

If an error is detected while copying a file, BCOPY closes the files, purges the entry from the queue, and attempts to delete the destination file. If the disk being copied to is full, BCOPY attempts to delete the partially written destination file and deletes the entry from its queue.

If EMS memory has been specified, an additional set of tasks must be performed. Each time the resident code is activated, the current context of the EMS driver is saved, using EMS function 8. BCOPY then uses EMS function 5 to map the page into the EMS page frame. When the resident code completes, the EMS context is restored with EMS function 9.

Removing the installed code from memory can be tricky. Because there is no guarantee that the resident code has completed the copies specified in its queue, the code to remove BCOPY must be included

■ **Working your way through BCOPY is useful when learning to design a TSR since it uses a variety of DOS functions.**

in the background, or resident section. If the remove flag has been set, and no files are in the queue, an attempt is made to remove the installed code. First, the three interrupt vectors used are checked to see if

they have been altered since installation. If not, the memory (including any EMS memory) is deallocated and the interrupt vectors are restored. If the vectors have been changed, BCOPY does not remove itself but will continue trying to do so every 1/2 second. If a new file is inserted into the queue, BCOPY will copy the file and then continue to attempt to remove the installed code.

Working your way through BCOPY is useful when learning to design a TSR since the program uses a variety of DOS functions while operating in the background. BCOPY shows how flexible DOS can be when asked. But even if you're not interested in it as a programming exercise, BCOPY will be a useful addition to your library of utilities. [E]

Douglas Boling is an electrical engineer who has been involved in the design of computer hardware and software for 11 years.

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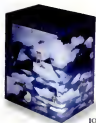
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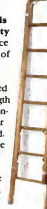


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OBJECT-ORIENTED PROGRAMMING



The graphical interface of the OS/2 Presentation Manager illustrates the greater flexibility inherent in object-oriented rather than structured programming.

In the last two Environments columns, I discussed how mouse input is handled in the OS/2 Presentation Manager. A mouse input event (such as a mouse movement or button click) is translated into a "message" that is sent to a window on the screen—the window underneath the mouse pointer at the time of the input event. The mouse message is processed by the window procedure for that window.

This use of the word "message" has its origins in object-oriented programming. In fact, the Presentation Manager, *Windows*, and the Macintosh are sometimes called object-oriented environments, because the operating system environment itself is structured around concepts common in object-oriented languages.

We can get a broader perspective on these concepts by examining the relationship between object-oriented programming and the Presentation Manager.

OBJECTS VS. STRUCTURES Most of us have grown up with the comfortable principles of structured programming, so it may be difficult to believe that there is anything fundamentally wrong with them. But structured programming is starting to show its age and deficiencies. Over the next decade it's likely that object-oriented programming will enter the mainstream and prove itself a worthy successor to structured programming.

The first full implementation of an object-oriented programming language was Smalltalk, which was developed, beginning in the early 1970's, at the Xerox Palo Alto Research Center. Smalltalk is both a

graphical windowing environment and a programming language. This was our first clue that there is perhaps a relationship between this type of environment and object-oriented languages.

Object-oriented programming languages are coming to the personal computer in a couple different forms. Actor, a programming language developed by the Whitewater Group, is a derivative of Smalltalk that runs under *Windows*. The Whitewater Group is also working on a version of Actor for the OS/2 Presentation Manager.

Perhaps the language that will do most to bring object-oriented programming into the mainstream is C++. C++ was first developed at Bell Telephone Laboratories by Bjarne Stroustrup in 1980. It is a superset of C that adds object-oriented extensions.

Everybody has a slightly different definition of object-oriented programming.

■ It's likely that object-oriented programming will enter the mainstream and prove itself a worthy successor to structured programming.

It's not easy to express the concepts in a few words, so let's approach the subject by examining what programs do and how a programmer uses a language to solve programming problems.

Programming involves the manipulation of data. A program manipulates data by performing actions (or operations) on the data. In structured programming, you do this by passing the data as parameters to procedures. We can express this symbolically as

parameters → procedures

The data are parameters to the procedure, and the procedure acts on the data. For example, when programming in C, if *X* and *Y* are floating-point numbers, you can pass *X* as a parameter to the *sqrt* function to obtain the square root of *X*:

Y = *sqrt* (*X*) ;

For some simple operations (such as addition and multiplication) you express the operation algebraically:

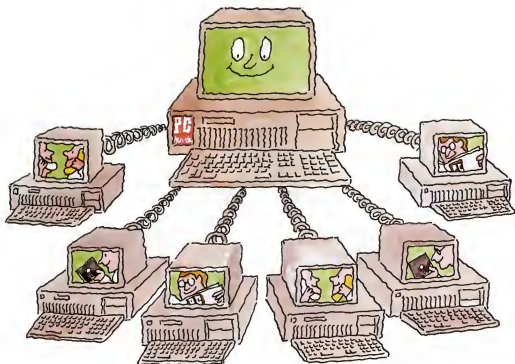
C = *A* + *B* ;

In some cases the operation will be performed without an actual procedure call, but the principles are the same.

In object-oriented programming, the process is reversed. The data is called an "object" and the action is called a "message." You perform an action on data by sending a message to the object:

messages → objects

You tell the data what action to perform on itself rather than tell a procedure what data



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■ ENVIRONMENTS

to perform an action on. In C++ you might find the square root of X and assign it to Y with a statement that looks like this:

```
Y = X.sqrt();
```

In this statement you're sending a `sqrt` message to the variable X. You're telling X to perform a square root operation on itself.

One essential difference is this: for the C `sqrt` function, the parameter must be a floating-point number, and the value the function returns is also a floating-point number. In C++, X and Y can be of any data type—including new data types that the programmer defines—providing it recognizes the `sqrt` message.

In an object-oriented language, an object comprises both a definition of the data and the operations that may be performed on the data. If the square root operation is part of the definition of an object, you can perform a square root by sending the object a `sqrt` message.

We can better appreciate the usefulness of object-oriented programming by examining a classic example: complex numbers.

COMPLEX NUMBER PROBLEM

A complex number comprises two numbers—a real part and an imaginary part. The imaginary part is a real number times *i*, the square root of -1. Various operations (such as addition and multiplication) on complex numbers are mathematically well-defined. But most programming languages do not recognize complex numbers. (FORTRAN is an exception to this rule.)

C supports several basic data types: integers, floating-point real numbers, pointers, and characters; and arrays, structures, and unions of these data types. C also supports several operations such as addition, subtraction, multiplication, division, and bit shifting. All of these operations are valid for integers and characters, but there are restrictions for the other data types. (For example, you can't bit-shift a floating-point number or multiply pointers.) The C compiler knows the internal organization of these data types, so it knows how to generate code to perform the operations on the data.

But suppose you want to use a data type

(such as a complex number) that is not defined in the C language, and you want to perform these standard operations (addition, subtraction, multiplication, and division) on the data. What would you do?

If you have the Microsoft C compiler, you'll discover, in the `MATH.H` header file, the definition of a structure called `complex`:

```
struct complex
{
    double x, y;
};
```

That's a good start. You can use this structure to define a few complex numbers in a C program:

```
struct complex cplx1, cplx2, cplx3;
```

But on searching further, you'll find that there is only one library function that ac-

■ In an object-oriented language, an object comprises both a definition of the data and the operations that may be performed on the data.

cepts a complex number parameter, and that is `cabs`, which takes the absolute value of the complex number.

You can't write a statement like

```
cplx3 = cplx1 * cplx2;
```

because the complex numbers are actually structures and C does not support the addition of structures. Instead, you'd have to write

```
cplx3.x = cplx1.x + cplx2.x;
cplx3.y = cplx1.y + cplx2.y;
```

And even if C were able to add structures by adding the individual fields, it surely couldn't multiply complex structures correctly:

```
cplx3 = cplx1 * cplx2;
```

You would have to multiply complex

numbers by using the following method:

```
cplx3.x = cplx1.x * cplx2.x -
          cplx1.y * cplx2.y;
cplx3.y = cplx1.x * cplx2.y +
          cplx1.y * cplx2.x;
```

You'd probably resort to writing a bunch of functions such as `MulComplex` to do this for you:

```
MulComplex (icplx3, icplx1, icplx2);
```

Or, you may wish you had used FORTRAN instead of C!

Of course, you would also like to pass complex numbers to all the floating-point-math library functions. For example, you would like to take the square root of a complex number:

```
cplx2 = sqrt (cplx1);
```

But for this you'd need another function called, for example, `SqrtComplex`.

Now suppose that in your program you also want to define a few more data types, such as vectors and matrices. You can easily define these data types as structures or arrays, but you'll also end up writing functions like `MulVector` and `AddMatrix`. Now you're accumulating a bunch of functions that perform the same type of operation (addition, multiplication, and so forth), but which only support individual data types. Each of these functions must be familiar with the internal organization of the data type it supports.

In short, the definition of new data types in most conventional languages is severely limited and essentially unsupported. So we have to ask ourselves: if structured procedural programming is so great, why is this such a mess?

THE SOLUTION The problem is that most conventional languages separate the definition of data from the procedures that act on the data. The definition of a new data type (such as a complex number) specifies only the way the data type is stored in memory. The procedures that act on this data type are separate from this definition.

In object-oriented programming, the definition of a new data type specifies not only how the data type is stored in memory, it includes the definitions of the operations that may be performed on the data as well. The definitions of these operations

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are referred to as "methods."

But of course! How an addition or multiplication operation works is so highly dependent on the data type that it makes no sense at all to define a data type independent of the operations that can be performed on it.

In object-oriented programming, to define a new data type you define a "class." When you allocate a variable of this data type, it's sometimes called an "instance" of the class or an "object." The class definition knows how to allocate memory for the object and how to perform operations on the object. You tell an object to perform an operation on itself by sending a message to the object.

In structured programming, a procedure is often treated as a "black box," which performs a certain operation in a predictable manner. The inner workings of the procedure can be hidden from the program that uses it.

In object-oriented programming, this concept is extended to the definition of data. The way in which the data type is stored in memory is hidden from the program that uses data of this type. The internal organization of the data type is of value only within the class definition. This protects programs from changes within the class definition and is called data "abstraction." It helps you modularize a program to a far greater degree than is possible in conventional structured programming.

The difference between object-oriented programming and structured programming is reflected less in what is actually going on behind the scenes than in how you approach and solve a programming problem. In fact, some C++ compilers are really translators that convert C++ source code into normal C code, which is then compiled. Everything you do in an object-oriented language can be expressed in more familiar structured-programming syntax. But to the programmer, the language seems quite different.

THE PM AND OBJECTS We seem to have drifted quite a distance from the OS/2 Presentation Manager and other graphical windowing environments. Or have we?

Of course, there is quite a difference between programming languages and operating system environments. Programming

languages are relatively independent of the environment in which the program runs. Using an object-oriented language to define new data types involves only a relationship between the programmer and the compiler, not a relationship between a program and the operating system. The operating system doesn't care how the programmer approaches a programming problem or what the program does on its own time and in its own memory space. Further, programming for the Presentation Manager certainly doesn't require an object-oriented language. Most Presentation Manager programming is currently done in plain old normal C.

An operating system is dedicated primarily to providing an interface between the program and the computer's input and output facilities, such as the file system,

■ An operating system is dedicated primarily to providing an interface between the program and the computer's input and output facilities.

keyboard, mouse, video display, printer, and so forth. Where object-oriented concepts fit into the Presentation Manager is in the interaction between programs and the user: getting input from the keyboard and mouse and displaying output to the screen.

As we have seen, a Presentation Manager program creates windows, and here is where the object-oriented terminology returns: A window is an instance of a window class. When you create a window, it is always based on a particular window class. Various window classes are predefined by the Presentation Manager. These include classes for frame windows, sizing border windows, button windows, scrollbar windows, and text entry-field windows. Programmers can also define their own window classes.

A window class definition essentially

defines a new data type, just like a data-type class in an object-oriented language. The class definition includes not only the allocation of data that is unique to each window based on the class, but also a window procedure that is responsible for processing messages (including user input messages) to the window and for displaying output on the screen.

Although a Presentation Manager window class is quite different in scope from a complex number class, there's a definite connection between the two. In object-oriented programming, a complex number object performs operations on itself when it is sent a message. In the Presentation Manager, a window object similarly performs operations on itself when it is sent a message.

The window procedure is part of the data type that is the window. The window procedure defines what the window looks like because the window procedure is responsible for painting the window on the screen. The window procedure defines how the window responds to user input because the window procedure processes this user input, which comes as messages.

MAKING BUTTONS An example will illustrate how this affects the structure of a Presentation Manager program.

If you were writing a DOS or OS/2 kernel program that used the mouse, you might want to draw a little push button on the screen. The user would be able to "push" the button by using the mouse to signal a command to the program.

For your button, you could draw a little oval and display text in it. When your program processes mouse input, it has to check for mouse clicks, and if any are found, determine whether the mouse was positioned over the area of the screen in which you drew the button. If so, the program can carry out the command for the button.

That seems like a reasonable way to implement a push button, but it's not nearly as elegant as the facility built into the Presentation Manager.

The Presentation Manager defines a window class for buttons. You can create a window based on this class by using one function call—WinCreateWindow. In this one function call, you specify the size of

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the window, the text that appears in the window, where the window is to be positioned relative to the client window, and other information.

The Presentation Manager creates a

new window based on the button window class. The window procedure for the button window class is in one of the Presentation Manager's dynamic link libraries. That window procedure processes all mes-

sages that are sent to the push button.

We have seen in the previous two Environments columns that the Presentation Manager routes mouse input to the window underneath the mouse at the time of the mouse input event. This means that when the user positions the mouse over the push button and clicks, the mouse messages are sent to the push-button window procedure rather than to your program's client window. The push button then sends a WM_COMMAND message to its owner (which is the client window of your program) to tell your program that the button has been pressed.

When you create a push-button window on the surface of your client window, your program does not need to draw the push button. The push button draws itself. Your program does not need to check for mouse clicks on the button, because the push-but-

■ The Presentation Manager creates a new window based on the button window class.

ton window procedure gets those mouse clicks. Nor does the push-button window have to check if the mouse click occurred over its window—if it gets a mouse message, then the mouse pointer was indeed over its window at the time of the click.

Like the new data-type classes that you define in an object-oriented programming language, the window classes defined in the Presentation Manager (or which you define in your program) can be treated as black boxes. Your program needn't be concerned with the data maintained within the push button window procedure, or how the window procedure handles messages, or even what the push button looks like.

So we see that a Presentation Manager window is a true object (in the object-oriented programming sense of the word), because a window is both the definition of a data type and a set of procedures that act on the data.

But what a data type! It processes user

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PRODUCTIVITY

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input and displays output to the screen. That's a data type to be reckoned with.

WINDOW METASTRUCTURES A graphical windowing environment is actually two environments. First, there is the user's environment: what the user sees on the screen and how he interacts with programs running under the environment. Second, there is the operating system environment, which involves the program's interactions with the operating system. Both of these are object-oriented.

In the Presentation Manager, the user's

■ You can interact with the various visual objects on the screen by using the mouse.

environment and the program's environment parallel each other. A user perceives the screen as containing various visual objects. Often these objects are windows, such as push-button windows, sizing border windows, menu windows, and scrollbar windows. The user can interact with these objects using the mouse. From the program's perspective, the windows are self-contained objects that interact with the user. When the user "pushes" a push button with the mouse, the push-button window receives the mouse message. The mouse is not only a simple pointing device—it also enables the user to become part of the object-oriented environment.

Just as programmers working with conventional languages structure their programs around a hierarchical series of procedures, programmers working with object-oriented languages add another layer of structure by defining new data types and methods. Similarly, programmers working in an object-oriented operating system add a layer of structure to their programs by creating windows that perform various tasks. That these windows can process input and display output makes them ideally suited to an interactive environment like the Presentation Manager. ■

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■ POWER PROGRAMMING ■ RAY DUNCAN

TAKING A REALISTIC LOOK AT DOS 4.0



From a programmer's viewpoint, IBM's latest DOS version hardly warrants the excessive reactions it has received. Here are the specifics you and your software should know about.

When IBM's DOS 4.0 first appeared, self-styled analysts and pundits hailed it as a major evolutionary step. They lauded its support for Lotus/Intel/Microsoft expanded memory (LIM EMS) and for large disk volumes, and they praised its inclusion of a visual user interface. Some went so far as to claim that DOS 4.0 eliminated much of the need for OS/2!

A few weeks later, the same analysts and pundits came to their senses and there was a severe backlash. DOS 4.0 was subjected to a torrent of abuse for a handful of bugs no worse than those that had accompanied the release of DOS 2.0 or 3.0, and for failing to live up to claims that IBM had never made for it. Such are the unfathomable twists and turns of our little corner of American industry.

I have no wish to venture into the debate over DOS's new shell, installation program, internationalization support, and user commands; I'll leave those issues to the sages. But in this column I would like to take a brief look at the changes in DOS 4.0 that affect the software developer.

EXPANDED MEMORY SUPPORT

The new system's much-discussed support for LIM EMS is perhaps its least significant feature. DOS 4.0 relies on an external Expanded Memory Manager device driver that is loaded with a `DEVICE=` directive in `CONFIG.SYS`, just like any other application that uses EMS. When expanded memory is available, DOS can use it for disk buffers (allocated with the `BUFFER=` directive) and for `FASTOPEN's`

filename cache, but it doesn't use expanded memory for application code or data swapping, nor does it put pieces of the operating system there.

The DOS distribution disks do include two device drivers for EMS. But these drivers work only on IBM expansion boards. If you're using an expanded memory board from another manufacturer, you'll have to continue to use the same company's EMS driver. Thus, DOS 4.0's EMS support reveals itself to be little more than a disk caching scheme that can use expanded memory—hardly a technological breakthrough. I strongly suspect that the only reason EMS support was included at all was to defuse criticism over the increase in the operating system's size.

Nevertheless, programmers who are writing programs that use EMS will find two of DOS 4.0's user-level enhancements helpful. The `MEM` command displays the location of each operating system component, including device drivers and the system file table; the address, length, and owner of each memory block in the transient program area; and the amounts of extended and expanded memory. `DEBUG` has been augmented with four new commands that let the programmer interactively allocate, deallocate, and map expanded memory pages. These new commands, shown in Figure 1, can be quite helpful when stress-testing an "EMS-aware" application.

HUGE DISK VOLUMES DOS 4.0's support for "huge" logical disk volumes (larger than 32MB) is almost completely

transparent to the user. The old partition types are still supported, disks written by previous versions of the operating system are still readable, and the operation of the `FORMAT` and `FDISK` programs is almost unchanged. The average user will notice only that `FDISK` no longer requires breaking up a physical disk larger than 32MB into a "primary partition" and one or more "extended partitions." The (theoretical) limit on a volume size is now 2,048MB (2 gigabytes).

Behind the scenes, of course, the ramifications of the new "huge" logical volumes are widespread. Although "well-



New DOS 4.0 DEBUG Commands

Command	Description
<code>XA n</code>	Allocate <i>n</i> pages of expanded memory and display the handle number for the pages
<code>XD handle</code>	Deallocate handle and its expanded memory pages
<code>XM /p handle</code>	Map expanded memory handle's logical page <i>p</i> to physical page <i>p</i>
<code>XS</code>	Display expanded memory subsystem status: total pages, pages available, current mapping, and active handles

Figure 1: The addition of these new `DEBUG` commands allows you to allocate, deallocate, and map expanded memory.

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behaved" applications are not affected, disk utility or "unerase" programs that rely on undocumented DOS functions and internal tables are likely to crash or damage data. This is because these functions and structures have been revamped to handle 32-bit sector numbers. Programs that use interrupt 25h and interrupt 26h to bypass the DOS file system and read or write "logical sectors" will continue to work unchanged on volumes smaller than 32MB, but they will need modification to access the new large volumes. The changes are indicated in Figure 2.

The huge volumes are implemented as a new partition type (6), and they have an extended BIOS Parameter Block and boot record format, which is diagrammed in Figure 3. The structure of directories and the FAT are unchanged—the rumors about a new FAT format with 20-bit entries were merely rumors—except that the FAT can now grow as large as 128K. (Previously,

the FAT was limited to the size of the first disk track.) Naturally, disk drivers that support the new partitions must be able to handle 32-bit sector numbers in the read and write request packets that they receive from the DOS kernel. They must indicate this capability by setting a flag in the device driver header, where it can be inspected by the kernel. In other respects, the specifications for device drivers are virtually the same as in DOS 3.3.

For all fixed disk partitions and floppy disk types, the DOS 4.0 FORMAT program calculates a semirandom 32-bit binary ID and places it in the boot sector that follows the BIOS Parameter Block. This ID can be used by the system's disk driver to determine whether a disk has been changed while a file is still open. That's a much more reliable method than checking the volume label assigned by the user, which has no guarantee of uniqueness. The binary ID is displayed by the CHK-



Interrupts 25h and 26h Under DOS 4.0

Call function with:

For access to partitions <= 32MB

AL drive number (0=A, 1=B, ...)
CX number of sectors to read (25h) or write (26h)
DX starting sector number
DS:BX segment:offset of buffer

For access to partitions > 32MB

AL drive number (0=A, 1=B, ...)
CX -1
DS:BX segment:offset of 10-byte parameter block in the following format:

Bytes	Description
00H-03H	32-bit sector number
04H-05H	number of sectors to read (25h) or write (26h)
06H-07H	offset of buffer
08H-09H	segment of buffer

Function returns:

If function successful

Carry flag clear

If function unsuccessful

Carry flag set
AX error code

Figure 2: New calling conventions for interrupt 25h (Read Logical Sector) and interrupt 26h (Write Logical Sector) in DOS 4.0 are required for access to volumes larger than 32MB.



DOS 4.0 Boot Sector Layout

00H	EB XX XX or EB XX 90
03H	OEM name and version
0BH	Bytes per sector
0DH	Sectors per cluster
0EH	Reserved sectors
10H	Number of FATs
11H	Number of root directory entries
13H	Total sectors if volume size <32MB
15H	Media descriptor byte
16H	Number of sectors per FAT
18H	Sectors per track
1AH	Number of heads
1CH	Number of hidden sectors
20H	Total sectors if volume size >32MB
24H	Physical drive number
25H	Reserved
26H	Extended boot sector signature (26H)
27H	32-bit volume ID
2BH	Volume label (11 bytes)
36H	Reserved (5 bytes)
3EH	Bootstrap program
200H	

Figure 3: A map of the extended boot sector and BIOS Parameter Block (BPB) on a disk formatted under DOS 4.0.

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DSK, DIR, VOL, LABEL, and TREE commands, but it cannot be changed by the user. DISKCOPY is smart enough to change the binary ID on the newly copied disk; DISKCOMP ignores the ID, and SYS preserves the ID when writing a new boot sector.

NEW FUNCTION CALLS DOS 4.0 contains only one completely new system call: interrupt 21h function 6Ch, Extended Open File. Figure 4 details its calling convention. This function combines the capabilities of interrupt 21h function 3Ch (Create File), interrupt 21h function 3Dh (Open File), and interrupt 21h function 5Bh (Create Unique File). It allows the programmer separately to specify how the function behaves if the file does or does not already exist, and it returns a code indicating the actual action taken by the function. The programmer can also now open or create a file specifying a "write-through" mode and "critical-error handling" mode. When the write-through bit is set, disk writes are always physically completed at the time they are requested, rather than possibly being buffered and deferred. If the critical-error bit is set, hardware errors during the open operation (such as "drive not ready") do not result in the usual "Abort, Retry, Ignore" message. Instead, they are returned to the application as a failure of the interrupt 21h function.

There are also a scattering of new sub-functions: interrupt 21h function 33h sub-function 05h, which allows a program to determine the system boot drive; interrupt 21h function 65h subfunction 07h, which returns a Double-Byte Character Set (DBCS) table important for support of Far East OEM versions of MS-DOS; and extensions to Generic IOCTL (interrupt 21h function 44h subfunctions 0Ch and 0Dh) to get or set the display mode and disk access flag. The changes to interrupt 25h and interrupt 26h have already been mentioned. Last (and even less interesting, if that is possible), the interface to the APPEND program via the Multiplex interrupt (interrupt 2Fh) has been expanded to allow a program to change APPEND's behavior "on the fly."

Aside from interrupts 25h, 26h, and 2Fh, all of the changes in the DOS 4.0 software interface—including interrupt



Using Interrupt 21h in DOS 4.0

Call function with:

AH = 6Ch

AL = 00h

BX = open mode

Bit(s)	Meaning
0-2	access type 000 = read only 001 = write only 010 = read/write reserved (0)
3	sharing mode 000 = compatibility 001 = deny read/write (deny all)
4-6	010 = deny write 011 = deny read 100 = deny none inheritance 0 = child process inherits handle 1 = child does not inherit handle
7	reserved (0)
8-12	critical-error handling 0 = execute INT 24h 1 = return error to process
13	write-through mode 0 = writes may be buffered 1 = physical write at request time
14	reserved (0)
15	reserved (0)
CX = file attribute	(bits may be combined; ignored if open)

Bit(s)	Meaning (if set)
0	read only
1	hidden
2	system
3	volume label
4	reserved (0)
5	archive
6-15	reserved (0)

DX = open flag

Bits	Meaning
0-3	action if file exists 0000 = fail 0001 = open file 0010 = replace file action if file doesn't exist 0000 = fail 0001 = create file
4-7	reserved (0)
8-15	reserved (0)

DS:SI = segment/offset of ASCII ptrname

Function returns:

If function successful
Carry flag = clear
AX = handle
CX = action taken
1 = file existed and was opened
2 = file did not exist and was created
3 = file existed and was replaced

If function failed
Carry flag = set
AX = error code

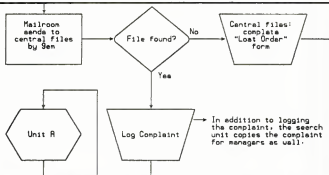
Figure 4: Interrupt 21h function 6Ch, Extended Open File, is an entirely new system call in DOS 4.0. As detailed in the text, several new subfunctions have also been added to interrupt 21h.

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21h function 6Ch—are clearly directed at compatibility with the OS/2 Application Program interface (API). Their evident purpose is to improve DOS's support for so-called "family applications," which can be executed either in protected mode (under OS/2) or in real mode (under DOS or in the OS/2 "DOS Compatibility Environment"). None of the changes will improve the performance of existing DOS programs or make it possible to write better programs.

WHERE'S THE BEEF? In sum, while DOS 4.0 certainly contains some improvements in usability and functionality, it offers nothing that warrants a major version-number change (from 3 to 4), let alone the kind of awe-struck coverage it initially received in personal-computer trade magazines. The visual shell merely follows in the footsteps of third-party products such as *XTREE*, *DESQview*, and *The Norton Commander*. The large-volume support is adapted from Compaq DOS 3.31; the EMS support turns out to be simple-minded at best; and you'd probably overlook the additions to the interrupt 21h programming interface completely if you didn't know exactly where to search for them in the manual.

DOS is not dead, but people who look to DOS for any further radical changes or improvements are looking in the wrong place. DOS is a prisoner of its own success and of that ill-behaved clients—the vast number of applications that grab all the memory they can get, depend on direct access to the hardware, and use undocumented DOS functions.

If you want effective multitasking, virtual memory, interprocess communications, and high-performance, hardware-independent graphics, you'll have to look to a protected-mode environment (such as OS/2 with Presentation Manager or Unix with X-Windows), where the hardware forces applications programmers to follow the rules.

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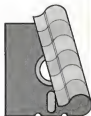
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Learn more uses for the F3 key, alternative symbols to use in graphs, and a useful way to intercept fatal errors with the {OnError} macro command in Lotus 1-2-3.

Rerouting a macro after an error with the {Dispatch} command

Lotus 1-2-3's {OnError} macro command provides a useful way to intercept otherwise fatal errors. When a macro error trips an {OnError} command, 1-2-3 routes the execution of the macro to the cell specified by the first argument of that command.

In most cases, you want each {OnError} command to route the execution of the macro to a different place. So you probably create a separate error routine for each of the {OnError} statements in your macro. This works, but it can make your macros somewhat bulky.

I've found a way to use a single error routine for almost all of the {OnError} commands in my macros. After each {OnError} statement, which specifies the location of the error routine, I insert a statement in the form

```
{Let LOCATION<@CELL(address",X)}
```

X is the name of the cell to which 1-2-3 should route the execution of the macro if an error occurs. Then, at the end of the error routine, I enter

```
{Dispatch LOCATION}
```

This commands 1-2-3 to route the execution of the macro to the cell whose address is stored in the cell named LOCATION.

The macro shown in Figure 1 uses this technique. The body of this macro, which occupies cells B1..B6, commands 1-2-3 to print a range you specify. Now suppose that while the macro is executing, you

	A	B	C	D	E	F	G
1	\P	{OnError CONTINUE,MESSAGE}					
2		{Let LOCATION,@CELL("address",\p)}					
3		/ppr(?)~q					
4	SECOND	{OnError CONTINUE,MESSAGE}					
5		{Let LOCATION,@CELL("address",SECOND)}					
6		/ppagq					
7							
8	CONTINUE	{Beep}					
9		{Recalc ERRMENU}					
10		{MenuBranch ERRMENU}					
11		{Quit}					
12	ERRMENU	ERR					
13		Press [Enter] to retry, or [Esc] to cancel...					
14		{Dispatch LOCATION}					
15							
16	MESSAGE						
17	LOCATION						
18							

Figure 1: The error routine in cells B8..B14 routes the execution of the macro to a different location, depending which {OnError} statement was tripped.

specify an invalid print range in response to the (?) command in cell B3 or your printer is disconnected, switched off, or off-line. The two {OnError} commands and the single error routine in cells B8..B14 will take care of both of these errors.

The {OnError} statement in cell B1 tells 1-2-3 to route the execution of the macro to the cell named CONTINUE (B8) if an error occurs and store the message that describes this error in the cell named MESSAGE (B16). The {Let} command in cell B2 then enters the label form of the absolute address of the cell named \p (B1) into the cell named LOCATION (B17).

Next, the statement in cell B3 instructs 1-2-3 to issue the /Print Printer Range command and then wait for you to specify

the range you want to print. If you specify a valid range, 1-2-3 will continue with the macro. However, if you specify an invalid range (for example, A1..IZ100) a macro error will occur. Because the {OnError} command in cell B1 will be active, 1-2-3 will store the error message "Invalid cell or range address" in the cell named MESSAGE and route the execution of the macro to the cell named CONTINUE.

In the routine that begins with CONTINUE, the first two statements tell 1-2-3 to beep and then recalculate the function @UPPER(MESSAGE) in the cell named ERRMENU (B12). This function returns an all-uppercase version of the error message stored in MESSAGE.

The next statement, {MenuBranch ERRMENU}, commands 1-2-3 to display

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a custom menu. This menu has the result of the function in `ERRMENU` (in this case, the string `INVALID CELL OR RANGE ADDRESS`) as its single choice, and the phrase "Press [Enter] to retry, or [Esc] to cancel . . ." as the prompt for that choice.

If you press `Esc` at this point, `1-2-3` will cancel the execution of the macro. However, if you press `Enter`, `1-2-3` will execute the command `{Dispatch LOCATION}` in cell `B14`, which routes the execution of the macro back to the cell whose address is specified by the label in the cell named `LOCATION` (`B17`). At this point, `1-2-3` will reset the error trap and allow you to re-specify the print range. `1-2-3` will continue in this fashion until you specify a valid range or cancel the execution of the macro.

Once you have specified a valid print range, `1-2-3` will execute the `{OnError}` command in cell `B4`, which replaces the error trap specified by the statement in cell `B1`. (These two statements are identical. However, the one in cell `B4` is needed in case a printer error occurs more than once.) Next, `1-2-3` will execute the command in cell `B5`. This replaces the current entry in `LOCATION` with the label form of the absolute address of the cell named `SECOND` (`B4`).

The final statement in cell `B6` instructs `1-2-3` to print the range you specified. If your printer is on, `1-2-3` will print the range and then end the execution of the macro. If there is a problem with the printer, however, a macro error will occur. In this case, `1-2-3` will enter the error message "Printer error" into `MESSAGE` and route the macro to `CONTINUE`. After beeping and recalculating the `@UPPER` function in cell `B12`, `1-2-3` will present a menu that has the result of that function (the string `PRINTER ERROR`) as its single choice, and the phrase "Press [Enter] to retry, or [Esc] to cancel . . ." as the prompt for that choice.

If you press `Esc` in response to this menu, `1-2-3` will cancel the execution of the macro. If you press `Enter`, `1-2-3` will execute the `{Dispatch}` command in cell `B14`. Since `LOCATION` will contain the label `B4` at this point, this command will route the macro back to cell `B4`. Now `1-2-3` will reset the error trap and reissue the `/Print Printer Align Go` command. If you

correct the problem with the printer before pressing `Enter`, `1-2-3` will print the report. If you don't correct the error, `1-2-3` will execute the error routine again. —James R. Knoblock; Bridgeport, West Virginia

Although the basis for this excellent macro is the `{Dispatch}` command, it contains two other programming features worth mentioning. First, it uses the optional second argument of the `{OnError}` command to store the message that explains the error that trips a command. Second, it uses the result of a string function (in this case, one that acts upon the stored error message) as a choice on a custom menu—something many `1-2-3` users may not ever have tried.

Using alternative symbols on 1-2-3 graphs

In my work with `Lotus 1-2-3`, I often plot series of data that contain hundreds of data points. Formatting a graph of this sort to display lines only or lines and symbols produces an unintelligible mess. In fact, due to the size of the symbols `1-2-3` uses, even formatting the graph for Symbols only does not produce a satisfactory graph, since the symbols overlap one another. Figure 2 shows a graph using the standard `1-2-3` symbols.

I have found a way to use any symbol I wish to mark points on a `1-2-3` graph. First, I insert a new column to the right of the column that contains the data I want to plot. Then I type the symbol that I want to use (a period, for example) in the cell to the right of the first data value and use the `/Copy` command to copy it into the cells to the right of the other data values.

Next, while defining the graph, I issue the `/Graph Options Format Graph` command and choose `Neither`. This tells `1-2-3` to use neither lines nor symbols to represent the data in the graph. Then, I issue the `/Graph Options Data-Labels` command, highlight the cells that contain the symbols that I entered, press `Enter`, and choose `Center`. This commands `1-2-3` to place the symbols precisely on top of the points where `1-2-3`'s default symbols would normally appear.

Finally, when I issue the `/Graph View` command, `1-2-3` draws the graph, using the symbols that I specified instead of its default symbols. Figure 3 shows the result of using this technique on the graph shown in Figure 2. As you can see, `1-2-3` now marks each point with a dot rather than a square. Since the dot is smaller than the square, the symbols do not overlap. The result is a clearer, more understandable graph. —Alfredo Somolinos; Dobbs Ferry, New York

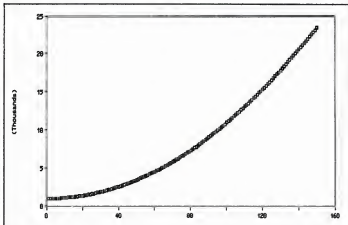


Figure 2: Due to the number of points in the graph shown above, the symbols for each point overlap the ones to the left and right of it.

■ SPREADSHEET CLINIC

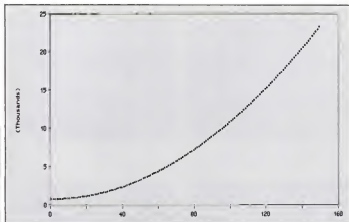


Figure 3: This graph charts the same data shown in Figure 2, but it uses a period instead of a square to mark each data point, thus avoiding overlapping.

In addition to making graphs easier to read, this technique makes them easier to modify. Instead of redefining your data ranges, you can simply delete the symbols that correspond to the points you don't want to plot. Furthermore, this method makes it easy to mark different points in the same range with a different symbol. For example, in a graph that uses periods to mark most of the data points, you may want to use an asterisk to mark every tenth point. To do this, you simply enter the alternative symbol into the appropriate cells of the worksheet.

More uses for the F3 key

In the June 28, 1988, Spreadsheet Clinic, you provided a valuable list of 1-2-3 commands that are affected by the F3 (Name) key. Unfortunately, you didn't list all of them. In addition to revealing a full-screen listing of range names when you issue a /Range command, the F3 key will reveal a full-screen listing of filenames when you issue any /File command (for example, /File Save, /File Retrieve, and so forth). While 1-2-3 is displaying a full-screen listing of filenames, it will display the size and creation date of the file whose name is currently highlighted.

The F3 key will also reveal a full-screen

listing of graph names when you issue the /Graph Name Create or /Graph Name Use command. It will reveal a full-screen listing of .PIC files when you issue the /Graph Save command, and will generate a listing of range names when you issue the /Data Regression command, the /Data Matrix command, and any /Graph command that lets you highlight a range.—Dennis Taylor; Boulder, Colorado

That's right—the list of possible uses of the F3 key goes on and on.

The F3 key works differently with the /File List command than it does with other /File commands. Since the /File List command automatically displays a full-screen listing of range names, pressing F3 once reduces the list to a single line at the top of the screen. Pressing F3 again restores the list to full-screen size.

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■ NEIL J. RUBENKING

USER-TO-USER



How to catalog the files on your floppy disk; create files of zero length; and verify volume labels with a batch file to make sure you're using the right disk.

A clean way to create files of zero length

Two techniques for creating zero-length files have been given in previous issues. One solution was to enter the command

```
TYPE X > Y
```

where *x* is a nonexistent filename and *y* is the name for the zero-length file. The other solution was to use DEBUG.

I have found a much better method. It doesn't cause the DOS "File not found" message (as the first solution does), and it is available in batch files (something DEBUG cannot do simply). Suppose you want to create a zero-length file called 0LENGTH.FIL. Just type in the following command:

```
TYPE 0LENGTH.FIL > 0LENGTH.FIL
```

DOS returns smoothly, prompting for the next command. The reason is that redirections are processed before a command is executed. Hence, 0LENGTH.FIL is created first and assigned to the standard output device. Then when the TYPE command is executed, 0LENGTH.FIL exists. Since it contains nothing, the process ends immediately, leaving the file on your disk. This tip works in DOS 3.1 and later.—*Tan Thanh Nguyen; Paris, France*

One correction: this technique works fine in DOS 2.0 and later.

There are several uses for a file of zero length. Let's suppose you need to confirm that a particular diskette is in a drive. The

volume label identifies a disk, but there's no batch command to check it. If you put a zero-length marker file on the disk, you can use the IF EXIST test to check for the presence of the marker. To do this, the lines in your batch file might look like this:

```
ECHO Put the UTILITY 3 disk in Drive A: and
PAUSE
IF NOT EXIST A:\UTILITY.003 GOTO WrongDisk
```

You could, of course, use any file as a marker. However, a zero-length file actually uses zero disk space, while a file containing even one byte uses a whole cluster. The only cost of a zero-length file is the 32-byte directory entry it uses.

You can also use zero-length files when preparing a floppy disk for distribution. You probably already arrange the files in a certain order. If there are two or more distinct groups of files, you can separate them in the directory listing with one or more zero-length files. The command

```
TYPE ----- > -----
```

will produce a dividing line. If you use

several dividers, you'll have to make each one slightly different. Replacing one dash with an underscore would do the job.

Note that you can't just create one zero-length file and copy it whenever you need another. DOS won't copy it. You really need a method like this one.

A batch file that catalogs the files on your floppy disks

Here's a simple batch file to catalog your floppy disks. CATALOG.BAT shown in Figure 1 writes each filename and user-specified disk title to the file C:\CATALOG.DIR. This catalog takes about two-thirds of the space required by a DOS directory written to disk. You can use the SORT program to sort the list by filename or disk name, or use the FIND utility to find an entry. If you change a disk, just delete that disk's files from CATALOG.DIR and recatalog it.

When writing this batch file, note that

```
ECHO OFF
CLS
IF "%1"==" " GOTO PARM
ECHO INSERT DISK IN DRIVE A -AND-
PAUSE
A:
FOR %%A IN (*.*) DO ECHO %%A ^I%1 >> C:\CATALOG.DIR
GOTO END
:PARM
ECHO FORMAT IS: "CATALOG diskname"
:END
```

Figure 1: CATALOG.BAT records the filenames from a floppy disk to a multidisk directory file.

■ USER-TO-USER

```

ECHO OFF
IF "%1"==" " GOTO PARM
IF NOT EXIST %1\*. * GOTO invalid
CD %1
FOR %a IN (*.*) DO ECHO %a  ^I%1 >> C:\CATALOG.DIR
GOTO END
:invalid
ECHO %1 is not a valid directory, or is empty.
GOTO END.
:PARM
ECHO FORMAT IS: "CATALOGD path"
:END

```

Figure 2: CATALOGD.BAT creates a list of the files in your various subdirectories.

```

ECHO OFF
ECHO About to delete all lines from CATALOG.DIR
ECHO that contain the string "%1". Press any key
ECHO to do it, or press Ctrl-Break to abort.
PAUSE > NUL
FIND "%1" C:\CATALOG.DIR > C:\CATALOG.OUT
TYPE C:\CATALOG.DIR | FIND /V "%1" > C:\CATALOG.TMP
DEL C:\CATALOG.DIR
REN C:\CATALOG.TMP CATALOG.DIR
ECHO Deleted lines are stored in C:\CATALOG.OUT

```

Figure 3: Use CATALOGX.BAT to remove disk data from your multidisk directory.

the line with the FOR command has a "I". This is ASCII character 9, the TAB character. You must select the appropriate key combination for your word processor. The three spaces before the "I" pad the filename field, so filenames with five or more characters will tab the disk name into the third column, making it easier to read the list. The output looks like this:

```

AUTOEXEC.BAT  USR2USR
COPYDIR.BAT   USR2USR
FINDALL.BAT   USR2USR
BEEP.COM      USR2USR
COMMAND.COM   USR2USR
COPYDIR.BAT   RAMDRIVE
CATALOG.BAT   RAMDRIVE
CATALOG.DIR    RAMDRIVE

```

The syntax is

```
CATALOG DISKNAME
```

where DISKNAME is the name you want to give to the disk being cataloged. When all disks have been cataloged, you can use the FIND program to find a filename and the disk name associated with it. When you SORT on the first field, you get an alphabetical list of all files in your "library." Most versions of DOS have FIND

and SORT, and there are other programs in the public domain or offered as shareware that will also serve the purpose. My favorites are LIST.COM (a file-viewing utility with a Find feature included) and SORTF.COM, both by Vernon Buerg. Of course, it's up to you to keep disks orderly and properly labeled.

With a few modifications, you can also catalog files in subdirectories on a hard disk. CATALOGD.BAT, shown in Figure 2, uses the chosen path instead of the disk name. A word of warning, though: if you use an invalid path, the current directory will be read and cataloged with that invalid pathname. —Dana Bell, Tyler, Texas

CATALOGD's lack of error checking was a little dangerous. If you entered an invalid pathname, you'd get misinformation in your catalog. So I added a little error checking, and now it won't catalog a directory that's empty or invalid.

If you get rid of a disk or change its contents, you will need a batch file to remove it from the catalog. Fortunately, DOS provides all the needed tools. CATALOGX.BAT in Figure 3 does the job. If you acci-



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■ USER-TO-USER

dentally delete more than you intended, it writes the deleted lines to CATALOG.OUT.

FIND selects all input lines with a particular string and writes them to its output. That's how CATALOG.OUT is generated. With the /V switch, FIND selects lines that do not contain this string and writes them to its output. Then the original CATALOG.DIR is deleted and CATALOG.TMP is renamed CATALOG.DIR. In the second use of FIND, the file is TYPEd and the output is piped to FIND, preventing FIND from inserting the filename at the top of the output file.

Two ways a batch file can verify the volume label to make sure you're using the right floppy disk

When using a batch file to copy or back up files to or from a disk, I find it helpful to

have the batch file check to make sure the correct disk is in the drive. While DOS provides a facility for assigning volume labels to disks, verifying the disk label in a batch routine is not straightforward. Indeed, the DOS manual states that "the volume label cannot be used in place of filenames as input to any of the DOS commands" (DOS 3.3 manual under "FORMAT"). However, the output of the VOL command (which displays the disk volume label) can be redirected to a file or filter. Using redirection of VOL output, I devised two ways to verify a volume label from within a batch file.

The first method is shown in Figure 4. The routine CHEKVOL1.BAT pipes the output of VOL through the FIND filter and sends the result to a batch file CHEKLABL.BAT. It then transfers control to that batch file. CHEKVOL1.BAT takes two command-line parameters, the drive name and the volume label. The volume

```
VOL B: | FIND /C "92" > CHEKLABL.BAT
CHEKLABL
```

Figure 4: CHEKVOL1.BAT will run 1.BAT if the label is verified, 0.BAT if it isn't.

label must be in capital letters.

Thus, for example, CHEKVOL A: UTILITIES would check to see if the string UTILITIES is the volume label for the disk in drive A:. Since FIND /C returns the number of lines containing the string, CHEKLABL.BAT will contain either the number 1 if the volume label was verified or 0 if it was not. Thus, you must create two additional files, 1.BAT and 0.BAT. The result of the volume label check will determine which one of these files will be executed. For instance, 1.BAT could consist of a backup routine and 0.BAT could ask the user to insert the proper disk and rerun CHEKVOL1.BAT.



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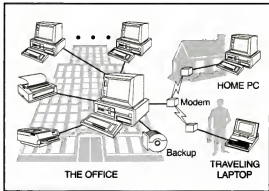
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■ USER-TO-USER

The second technique is shown in Figure 5. The routine CHEKVOL2.BAT redirects the output of the VOL command to CHEKLABL.BAT and executes CHEKLABL.BAT. The output of VOL will be a string such as

```
Volume in drive A is VOLUME LABEL
-or
Volume in drive A has no label
```

CHEKLABL.BAT will run the file called VOLUME.BAT with five or more parameters. You must create the VOLUME.BAT file that is shown in Figure 6 beforehand. The fifth parameter of VOLUME.BAT contains the actual volume label, and DISKID is the string given by the user as a parameter of CHEKVOL2.BAT. If these two strings are equal, then the volume label is correct.

Of course, instead of using the volume label to verify disk identification, you could use a dummy file and simply check

```
ECNO OFF
IF "%2"==" " GOTO syntax
VOL %1 > CHEKLABL.BAT
SET DISKID=%2
CHEKLABL
:syntax
ECNO SYNTAX: "CHEKVOL2 drive label", e.g. "CHEKVOL2 A: UTILITIES"
```

Figure 5: The CHEKVOL2.BAT file above works with the VOLUME.BAT file shown in Figure 6 to verify that you have the right disk in the drive.

for its presence using IF EXIST. However, it would be necessary to place a dummy file on each disk. Moreover, the dummy files could be erased. DOS gave us the volume label, so we ought to be able to use it, rather than clutter our disks with dummy files.—Grant M. Carrow; Arlington, Massachusetts

CHEKVOL1.BAT has one major limitation: if you check any substring of the volume label, it will verify it. For example, if

the volume label is VOLUME LABEL, CHEKVOL1 A: LAB will proceed as if you had the correct disk in the drive. Also, the CHEKVOL1 batch file will always verify any label that's a substring of the VOL message, for example, "Volume" or "drive."

CHEKVOL2 is much better, but there's a catch. It's possible to put spaces in volume labels, and spaces separate batch file parameters. If your disk's volume label is FUBAR SNAFU, the follow-

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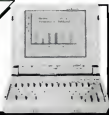
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Liven up dBASE programs with motion and color; be wary of WordPerfect's "Text was not modified" message; a fast way to append records from dBASE files.

Here's a fast way to append records from files that have a dissimilar data structure

If every database used the exact same structure, appending records from one database to another would be easy. Unfortunately, the world isn't like this. For example, suppose you have an employee database and need to APPEND FROM another employee file. You'll frequently find that the field contents of both files are basically the same, but the fieldnames are different.

If you use the built-in APPEND FROM command in dBASE-language programs, only the data from fields with common fieldnames will be appended. If the fieldnames are dissimilar, therefore, you must use the MODIFY STRUCTURE command to make the fieldnames match before you execute the APPEND FROM command. If the source file is very large, this will be very time-consuming—and you may not have enough disk space.

The FoxBASE Plus procedure shown in Figure 1 performs the APPEND even if the fieldnames are different. The key is to use the FoxBASE Plus (Version 2.0) SCATTER and GATHER commands. The procedure assumes that the fields are in the same order in both files. If they're not, a FIELDS clause may be added to define the correct field sequence. The procedure shown here can be easily modified to perform conditional APPENDs, making it versatile in addition to being fast.—K. A. Gunaratne; Hong Kong

FoxBASE stands alone in its ability to perform this frequent data management operation quickly and efficiently. With other dBASE languages one must either MODIFY STRUCTURE, as this letter suggests, or else create an ASCII text file of the second database with the COPY TO . . . SDF command, and then APPEND FROM . . . SDF into the main database. Both approaches are lumbering elephants compared with Fox's SCATTER and GATHER array commands.

Non-FoxBASE users can initialize a set of memory variables from the second database's fields and REPLACE to fill the fields in the primary file within a DO WHILE loop. A large database will have to be run overnight!—Brad Stark

Using the "unusable" characters to draw lines in Microsoft Word 4.0

One of Word 4.0's handier features is the ability it gives you to draw lines with your choice of character. Enter O at the command line to choose the option menu, where you select the line-draw character option. Next, hit F1 and either pick from the characters shown on the screen or type a character to define your own choice. Then go back to the document, use Ctrl-F5 to turn on line drawing, and use the cursor keys to draw the lines.

Unfortunately, there are some useful characters that the program will not let you type in and use to draw. These include the

```
*** APPEDIFF.PRG
*** procedure for dissimilar append
PARAM sourc,destn

SELE B
USE &destn
SELE A
USE &sourc
DO WHILE .NOT. EOF()
  SCATTER TO temp
  * STOREs source fields in temp array
  SELE B
  APPE BLAN
  GATHER FROM temp
  * REPLACES destn fields with array
  SELE A
  SKIP
ENDD
```

Figure 1: Here is a simple, fast FoxBASE Plus procedure for appending records from a dissimilar database structure. The key is to use the FoxBASE Plus SCATTER and GATHER commands.

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smiley faces (ASCII 1 and 2), hearts (ASCII 3), and musical notes (ASCII 14).

Search and replace gives you an easy way around this limitation. Simply draw your lines with any of the standard line-draw characters, then use *Word* to search for and replace those characters with any character of your choice. To replace selected characters with one from either the IBM high-order character set or with one below the printable ASCII range, enter the character by holding down the Alt key and typing the appropriate ASCII code on the numeric keypad.

One final point: remember that in order for these lines to print correctly, your printer must be able to print the full IBM character set.—*Ermine Todd III; Santa Clarita, California*

If you want to draw lines using hearts or smiley faces only occasionally, the search and replace command will serve your needs. But if you need to draw such lines often, you'll want to automate the procedure. Figure 2 shows a macro that sets the line-draw character to a tilde, turns on the

line-draw feature, and pauses to let you draw your lines. When you finish drawing, hit Enter. The macro will then start the search and replace command, pause to let you enter your desired character, and replace all the tildes with your choice of character.

Notice that in order to replace all the tildes in the file, you must first jump to the beginning of the file. The Set and the While . . . Endwhile commands allow you to find your place in the file again. The advantage of using a seldom-used character like the tilde is that you will not accidentally replace line-draw characters that you did not mean to replace. Naturally, if you regularly use the tilde character, you will want to use a different character in the macro.—*M. David Stone*

Here's a way to liven up dBASE programs with motion and color

The clear-screen routine presented in Figure 3 will add movement and color to a dBASE program by simulating the action

```
<esc><left><up>~<enter><ctrl f5>.<pause>
<esc><Ctrl pgup>r<Tab>.<pause>
<set char=field><tab><tab><tab><tab><enter>
<while found><esc>s<char><tab>d<enter>.<endwhile>
```

Figure 2: This line-draw macro will let you draw lines in Word 4.0, using characters that Word will not normally accept. The macro draws the lines using tildes, then searches for the tilde character, pauses to let you replace it with your character choice, then automates this process.

```
SET TALK OFF
SET COLOR TO N/N
STOR # TO col,row
DO WHILE col<36
  @ row,col CLEAR TO row,79-col
  @ 24-row,col CLEAR TO 24-row,79-col
  @ row,col CLEAR TO 24-row,col+3
  @ row,79-col-3 CLEAR TO 24-row,79-col
  row=row+1
  col=col+3
  * INKEY(.05) && Clipper only, else:
  x=#
  DO WHILE x<25
    x=x+1
  ENDDO
ENDDO
SET COLOR TO W/N
CLEAR
```

Figure 3: This routine will simulate a cameraklike "fade out" in dBASE programs.

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CIRCLE 132 ON READER SERVICE CARD

■ POWER USER

of a camera "fade out." It clears the screen one "ring" at a time, each ring being one row high by three columns wide. The slight delay between each ring is optional. I often use clear-screen when exiting a program.—*Kent Myers; Hermosa Beach, California*

Sometimes a good visual effect can be cognitively useful as well as lending eye relief. While Mr. Myers uses this procedure when exiting a program, it could also be used to good effect in a computer presentation or demonstration program, and it could provide a visual analogy to closing one main database and opening another database.

I've taken the liberty of making the *Clipper*-specific code generic so that it can be used by any modern *dBASE* language application. To do this, I actually weakened the routine in one sense, since it was necessary to substitute the 3-line **DO WHILE x<25** delay loop for his single *Clipper* command, **INKEY(.05)**, which causes a .05-second delay between the moving rings. *Clipper*'s ability to accept a time parameter inside the **INKEY()** function makes the routine independent of the CPU's processing speed.

In implementing the **DO WHILE** delay loop, you'll want to experiment with the **x<25** parameter to get the speed that's right for your computer. Users of *dBASE III* should remove the delay loop altogether—an interesting commentary on how much slower *dBASE III* runs than its competition.

You'll also want to experiment with the **SET COLOR TO** parameters. If you have a color monitor, interesting effects can be achieved by varying the colors invoked by the first **SET COLOR TO** parameter. The second **SET COLOR TO** parameter should reset the color to your original scheme; the final **CLEAR** then repaints the screen.—*Brad Stark*

You can't always trust WordPerfect's "Text was not modified" message

Neil J. Rubenking's comments (May 31, 1988) regarding *WordPerfect*, Version 4.2's literal meaning of "Text was not

modified" brings to mind a similar but potentially more destructive situation. I sometimes do major revisions to the structure of a document by cutting sentences, paragraphs, and chapters from doc 1 and stashing them in doc 2 temporarily until I decide where to put them in the final text. I found that if you use doc 2 only as a clipboard and do not edit anything there, *WordPerfect* gives you the same "Text was not modified" message before exiting. You would think that pasting in umpteen pages would qualify as "modifying text," but apparently it doesn't.

As soon as you chop a piece out of doc 2 to put back into your masterpiece, *WP* recognizes that you have modified the text. So this won't often be the cause of lost work. It can happen though—once had to unerase **(WP)BACK.2** to resurrect about 50 pages.—*W. George Smith; St. John's, Newfoundland*

This whole problem comes about when you exit *WordPerfect* and see the "Text was not modified" message on the line that's asking you "Save document?" Contrary to what the situation requires, the presence of the "not modified" message would suggest that you don't need to save. Fortunately, the problem mentioned here is fixed in *WordPerfect* 5.0. Even if you are creating a document entirely by pasting in bits and pieces of it from elsewhere, you won't get the "not modified" message.

However, the previous problem remains. If you edit a document and change only certain minor codes, *WordPerfect* will claim the text was not modified. The Bold and Underline codes fit this definition, as perhaps do others. Be wary!—*Neil J. Rubenking*

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CIRCLE 351 ON READER SERVICE CARD

■ EDITED BY ROBERT L. HUMMEL

LANGUAGES

Enhance the EXEC procedure using the new routines in Turbo Pascal 5.0; expand DOS command parameters using EXP.C; test unique sounds with this Turbo Pascal program.

Test various noises for your Turbo Pascal programs with this amusing routine

A well-written program should be a sight-and-sound experience. However, the internal procedure Sound()—or even worse, Write(#7)—is nothing short of real boredom. To overcome this, I wrote a small procedure that I now include in each program I write. The result is an easy way to produce all sorts of sounds.

NOISE.PAS takes a handful of integer parameters that describe how to use Sound() and Delay(). Simply code it in as shown in Figure 1 and include the file at the beginning of your source using {\$I

NOISE.PAS}. Each time you wish to make weird noises at the user, just say

```
NOISE(b,e,s,d,t,p);
```

where

b = starting frequency in hertz
e = ending frequency in hertz
s = step value from start to end
d = delay in milliseconds between frequency steps
t = how many times the entire sound should be repeated
p = amount of pause in milliseconds between each repeat

NOISE calls can be combined to make all sorts of sounds.—E. Kasey Kasemodel; Ann Arbor, Michigan

I added three more sounds to the demo. It's surprising how many sounds the simple NOISE routine can make. Not every program requires unique sounds, but a dis-

tinctive beep can add a certain flair.

NOISE goes through a series of frequencies in steps of fixed size and for a fixed duration at each step. One possible enhancement: add multipliers for both the step and the duration. A multiplier greater than 1 would increase the item on each pass; less than 1 would decrease it. Of course, you'd set the multipliers to 1 for behavior identical to the existing NOISE program.—Neil J. Rubenking

New features in Turbo Pascal 5.0 make a more perfect EXEC

Turbo Pascal 4.0 introduced the built-in EXEC procedure, which allows one pro-

```

PROGRAM DEMO FOR NOISE;
(* Written by E. Kasey Kasemodel *)
(* Delete the next line for TDS *)
USES CRT;
VAR H: byte;

PROCEDURE NOISE(start, (starting frequency)
                  stop, (ending frequency)
                  step, (step size)
                  Del, (time per step)
                  Time, (repeat of whole sound)
                  Pause (pause between repeats)
                  : integer);
VAR
  s, diff, a: integer;
BEGIN
  s := start;
  diff := s;
  a := s;
  FOR s := 1 TO Time DO
    BEGIN
      SOUND(a); Delay(Del); NOISOUND; (* make sound the first time *)
      REPEAT
        IF start > stop THEN (* noise goes down *)
          BEGIN
            a := a-step; (* take step value away from current freq *)
            diff := a-stop; (* check difference between freq and stop *)
          END
        ELSE (* noise goes up *)
          BEGIN
            a := a+step;
            diff := stop-a;
          END;
        SOUND(a); Delay(Del); NOISOUND; (* produce updated sound *)
      UNTIL (diff < 0);
    END;
  (* keep looping til freq goes past stop *)
  (* start over for another loop *)
  (* wait between loops *)
  (* do it again if necessary *)
END;

BEGIN
  CLS;
  WRITELN('NOISE.PAS By E. Kasey Kasemodel');
  Write('01 '); NOISE(100, 50, 1, 5, 0, 100); Delay(1000);
  Write('02 '); NOISE(100, 250, 10, 50, 3, 100); Delay(1000);
  Write('03 '); NOISE(2000, 250, 50, 5, 2, 100); Delay(1000);
  Write('04 '); NOISE(50, 2500, 50, 5, 4, 50); Delay(1000);
  Write('05 '); NOISE(4000, 1000, 150, 2, 2, 50);
  NOISE(1000, 4000, 150, 3, 3, 50); Delay(1000);
  Write('06 '); NOISE(1000, 4000, 100, 3, 3, 50);
  NOISE(4000, 250, 50, 3, 2, 75);
  NOISE(50, 5000, 132, 4, 2, 25);
  NOISE(2000, 1000, 50, 3, 3, 50); Delay(1000);
  Write('07 '); NOISE(2000, 2000, 2, 2, 2, 50); Delay(1000);
  Write('08 '); FOR H := 1 TO 8 DO
    BEGIN
      NOISE(1000, 2000, 15, 2, 1, 0);
      NOISE(2000, 1000, 15, 2, 1, 0);
    END;
  Write('09 '); NOISE(1000, 2000, 500, 2, 200, 0);
END.

```

Figure 1: Use the NOISE procedure to experiment with sound for your programs.

■ LANGUAGES

gram to execute another. However, EXEC isn't as forgiving as the DOS command line. You have to give it the full pathname of the program you want—it won't guess the extension and it won't search the PATH. Another minor problem is that Turbo Pascal 4.0 takes over certain interrupt vectors and keeps them during the EXEC call. For example, if your Pascal program has Ctrl-Break checking turned off, you won't be able to use Ctrl-Break during the EXECed program either.

The FSearch, FExpand, GetEnv, and SwapVectors routines, new in Version 5.0, can enhance EXEC. FSearch and GetEnv let you search the PATH for a file, FExpand makes the found filename into a fully qualified pathname, and SwapVectors swaps the original interrupt vectors with those installed by the runtime library.

FSearch takes two parameters: a filename and a list of directories separated by semicolons. It returns the full pathname of the first match, or an empty string if it finds no match. GetEnv returns the environment string corresponding to a given environment variable. Hence, FSearch(filename, GetEnv('PATH')); will find a file anywhere on the path.

FExpand cleans up filenames. Often a filename search will produce a result like ..\DATA\TEST.DAT. FExpand returns a fully qualified filename that's not dependent on the current directory. The above example might become C:\DATA\TEST.DAT.

Every Turbo Pascal 5.0 program replaces a certain number of interrupt vec-

tors, saving the original vectors in a series of variables. For each interrupt, SwapVectors exchanges the saved vector with the current one. Call it once before EXEC to restore the originals, and again after to put back the replacement interrupts.

The program in Figure 2 pulls together all of these concepts. It accepts a filename just as you would type it at the DOS prompt, and searches for it just the way DOS would. First it looks in the current directory for a matching .COM, .EXE, or .BAT file. Since FSearch always searches the current directory, calling it with a null string for PATH searches *only* the current directory. If we don't find it there, we do the same thing for the full PATH. It's necessary to do this in two stages, because otherwise a .COM file on a distant path would take precedence over a .BAT file in the current directory.

Next the program cleans up the found filename with FExpand and prepares to EXEC it by restoring the original interrupt vectors. If it's a batch file, the program needs to EXEC a secondary command processor. It uses GetEnv('COMSPEC') to locate COMMAND.COM—much better than just guessing that C:\COMMAND.COM will be correct.

As usual with EXEC, the program's memory requirements are set to the lowest possible value. In this case, that's the utter minimum, {\$M 1024,0,0}. If you use this technique in your own program, you'll almost certainly have to raise these limits.

Just don't raise them more than you have to.—Neil J. Rubenking

Nonrecursive method gets a directory tree using less stack space in Turbo Pascal

While writing a terminate-and-stay-resident (TSR) program, I wanted to include a routine that printed the disk's directory structure. A recursive algorithm seemed to be the most efficient method in terms of code size, but allocating a temporary stack while resident was wasteful of memory and cumbersome. I used a nonrecursive solution with Turbo Pascal 4.0. The routine is basically a tree traversal using a left-root-right algorithm. The nested constant can be changed to allow for the maximum number of nested subdirectories.—Bill Roohi; Metairie, Louisiana

Recursive algorithms are often elegant, but every recursion level eats up stack space to hold local variables and parameters. Sometimes you can't predict the exact number of recursion levels, so you can't estimate the program's stack usage.

Worse, performing any string operations within the recursive procedure loses stack space reserved for the string routines. I recently debugged a recursive routine that was using an extra 256 bytes per level, all because it used one line of the form WriteLn('ERROR: '+Message);. The + is a string concatenation operator, and that caused the problem.

The program in Figure 3 minimizes stack use, not execution time. It takes longer than the recursive method because

```

{$M 1024,0,0}
PROGRAM Exec_Demo;
(*By Neil J. Rubenking*)
(*demonstrates the use of new TP 5.0 routines *)
(*to enhance the EXEC procedure. *)
USES Dos;
VAR
  WhatProg, Found : PethStr;
BEGIN
  Write('Enter the program name just as you');
  WriteLn(' would at the DOS prompt, with NO');
  Write(' extension and NO path. It can be a ');
  WriteLn(' .COM, .EXE, or .BAT file. ');
  Write('Program name: ');
  ReadLn(WhatProg);
  Found := FSearch(WhatProg+'.COM', '');
  IF Found = '' THEN
    Found := FSearch(WhatProg+'.EXE', '');
  IF Found = '' THEN
    Found := FSearch(WhatProg+'.BAT', '');
  IF Found = '' THEN
    Found := FSearch(WhatProg+'.COM', GetEnv('PATH'));
  IF Found = '' THEN
    Found := FSearch(WhatProg+'.EXE', GetEnv('PATH'));
  IF Found = '' THEN
    Found := FSearch(WhatProg+'.BAT', GetEnv('PATH'));
  IF Found = '' THEN
    BEGIN
      WriteLn('Sorry, I cannot find "', WhatProg, '" anywhere!');
      Halt(1);
    END;
  Found := FExpand(Found);
  WriteLn('Freeing memory to execute ', Found);
  ReadLn;
  SwapVectors;
  IF Pos(' ', Found) > 0 THEN
    EXEC(GetEnv('COMSPEC'), '/C ' + Found);
  ELSE
    EXEC(Found, '');
  SwapVectors;
  CASE DosError OF
    0 : WriteLn('Successful completion');
    1 : WriteLn('Invalid function');
    2 : WriteLn('File not found or path invalid');
    3 : WriteLn('Access denied');
    4 : WriteLn('Insufficient memory');
  END;
END.

```

Figure 2: New routines in Turbo Pascal 5.0 can enhance the EXEC procedure.

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CIRCLE 485 ON READER SERVICE CARD

■ LANGUAGES

each time it returns to a given level, it has to search that level again until it finds the point it reached before, then proceed to the next directory. That's what the directory names stored in the array `LastDir` are for. The important thing is that this procedure gets the job done in a defined amount of stack space.—Neil J. Rubenking

Using a C program to expand DOS command parameters

While working with another operating system, I found a capability I've often wanted to use with DOS commands. If it were available, the following would be an ex-

ample of valid COPY command syntax:

```
COPY (FILE1,FILE2,FILE3).BAT A:
```

So would the command

```
COPY PROGRAM.(C,EXE) A:
```

The former would copy FILE1.BAT, FILE2.BAT, and FILE3.BAT to drive A,

```
PROGRAM dirtree;
(* DIRTREE.PAS
  Directory tree display
  written by Bill Stuehl, 1989
*)
USES dos;

CONST nested = 18; (* up to 18 nested levels *)

VAR dirinfo : searchrec;
    lastdir : ARRAY[1..nested] OF STRING[12];
    level : Integer;
    path, blank : STRING[150];
    ok : Boolean;

BEGIN
  ok := True; (* initialize *)
  level := 0; (* start at level 0 *)
  FillChar(blank[1], 150, 32); (* start for tabs *)
  blank[0] := '150';
  GetDir(0, path); (* get current path *)
  Chdir(''); (* root directory *)

  Findfirst('*.*', anyfile, dirinfo); (* start search *)
  WHILE ok DO
  BEGIN
    WHILE (doserror = 0) AND
      ((dirinfo.attr <> 16) OR
       (dirinfo.name = '.')) OR
      (dirinfo.name = '..') DO
      BEGIN
        (* find next *)
        Findnext(dirinfo);
        Dec(level); (* previous level *)
      END;
      (* look for match *)
      Findnext(dirinfo);
      Dec(level); (* previous level *)
      (* skip past it *)
      Chdir(path); (* to original path *)
    END;
  END;
END;
```

Figure 3: The listing for DIRTREE.PAS, a directory tree display that works without recursion.

```
/* exp.c
 * For MS-DOS 4.0/5.0/Quicks: el exp.c
 */
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#include<ctype.h>

#define TRUE 1
#define FALSE 0

#define DOS_COMMAND_LINE 128
#define LPAREN '('
#define RPAREN ')'
#define PERIOD '.'
#define BLANK ' '

main(argc, argv)
int argc;
char **argv;
{
  int i, echo_only = FALSE;
  char oldcommandline[DOS_COMMAND_LINE], newcommandline[DOS_COMMAND_LINE];
  char *lparen, *rparen, *period, *first_arg, *last_arg, *oldcommand;

  if(argc < 2)
    print_usage();

  /* check for echo only argument, and if so, set flag, increment
   arg pointer, and decrement the arg count */
  if((argv[1][0] == '-' || argv[1][0] == '/') && toupper(argv[1][1]) == 'E')
  {
    echo_only = TRUE;
    argv++;
    argc--;
  }

  /* put all command-line arguments into one buffer */
  for(i = 1, oldcommandline[0] = NULL; i < argc; i++)
  {
    strcat(oldcommandline, argv[i]);
    strcat(oldcommandline, " ");
  }
  lparen = strchr(oldcommandline, LPAREN);
  rparen = strchr(oldcommandline, RPAREN);
  period = strchr(oldcommandline, PERIOD);

  /* check syntax: if no parg or if parg reversed */
  if(!lparen || rparen || (rparen < lparen))
  {
    print_usage();
    return;
  }

  /* check syntax: if period supplied and in middle */
  if(period && (period < rparen) && (period > lparen))
  {
    print_usage();
    return;
  }

  /* set last arg to the remainder of the command line after our
  expanded filename/extension */
  last_arg = (rparen+1);

  /* copy up to the first paren into the new command buffer */
  strcpy(newcommandline, oldcommandline);
  newcommandline[lparen-oldcommandline] = NULL;

  /* set first arg to where the first argument will start each time */
  first_arg = oldcommandline[lparen-oldcommandline];

  /* point to first expansion */
  lparen++;

  /* main loop:
  pick off each filename/extension,
  copy it into the buffer,
  turn on additional arguments
  run the command.
  */
  while(TRUE)
  {
    if(first_arg == NULL)
      exit(1);
    oldcommand = strchr(lparen, ","); /* find the next , or */
    if(oldcommand == NULL) /* NULL terminates */
      strcpy(first_arg, lparen); /* add to the command */
    else
      strcpy(first_arg, oldcommand+1); /* add to the command */

    if(echo_only)
      printf("exp: %s", newcommandline); /* echo the command */
    else if(system(newcommandline)) /* execute the command */
      printf("exp: %s\n", newcommandline); /* print error message */

    lparen = strchr(lparen, ","); /* move to next arg */
    if(lparen == rparen)
      break;
  }
  exit(0);
}

print_usage()
{
  printf("exp [-E] DOScommand [filename,...,filename].ext");
  printf("exp [-E] DOScommand filename.[ext1,...,extn]");
  printf("\n");
}
```

Figure 4: EXP.C adds versatility to DOS by automating repetitive commands.

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| D <input type="checkbox"/> Corporate Purchaser | |
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| B <input type="checkbox"/> 386 architecture | C <input type="checkbox"/> Over 21 |
| 3. Are you interested in computer products for: | 6. Is your requirement: |
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■ LANGUAGES

and the latter would copy PROGRAM.C and PROGRAM.EXE to drive A.

I wrote the program EXPAND.C, shown in Figure 4, to allow me to use these types of commands. The program saves the second parameter of a command for a left parenthesis, parses each separate filename or extension, and constructs and executes a separate command for each one. For example, entering

```
EXP COPY (FILE1,FILE2,FILE3).BAT A:
would generate these three commands:
```

```
COPY FILE1.BAT A:
COPY FILE2.BAT A:
COPY FILE3.BAT A:
```

—Leslie Houk; Alexandria, Virginia

I shortened the name from EXPAND.C to EXP.C since I thought it should be terse like DOS commands; then I added some rudimentary error checking and simplified the code a bit. I also added an option, -E, that will echo the commands instead of executing them. EXP is limited to internal DOS commands (COPY, DEL, DIR, CD, MD, RD, and so on), but it can be modified to work with external commands.

The program works by copying the entire DOS command line (minus the program name and the option flag) into a buffer. After pointers are set up to expand the names in parentheses and the syntax is checked, a new command line is prepared with the DOS command. Then, in a loop, each of the arguments is copied into the new command-line buffer and executed. All of the work is done with the pointers.

EXP uses the strpbk() function to find the delimiters in the command string, and uses the system() function to execute the DOS commands.—Richard Hale Shaw

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■ ROBERT L. HUMMEL

PC TUTOR



Processing DOS redirection commands; accessing the CLOCK\$ device driver; writing interrupt handlers using DOS functions; controlling keyboard lock functions.

DOS processes redirection commands even if they're in REM statements

I've noticed an interesting effect in my batch files. When I include any of the redirection symbols (< , > , or |) in a REM (remark) statement, they execute just as if I had used them in a normal batch command. Is this due to a bug in DOS 3.0?

Is there any way that I can use them in a nondisplaying remark without having them execute?—Bill Kraengel, Jr.; Valley Stream, New York

First, this isn't a bug in DOS. At least it's not a bug in the normal sense of the word—a programming error. It's a logical but undesirable side effect of the method DOS uses to parse commands.

Every command line sent to DOS, whether typed in at the prompt or read by DOS from a batch file, is first scanned for the three DOS redirection characters: < , > , and |. These commands must be found and processed for redirection of normal DOS input and output to be in effect during the program executed by that command. Since the scanning takes place before the command is even examined, DOS treats the characters following the REM command as if they were part of an executable statement.

So, for example, if DOS scanned the command

```
DIR > FILE.TXT
```

it would create a file named FILE.TXT in

the current directory. The DIR command would then be executed with the output redirected to standard output. The file FILE.TXT would be opened, written to, and then closed by DOS. In similar fashion, the command

```
REM > FILE.TXT
```

receives the same treatment. In the case of the REM command, however, no output is produced. The file created, therefore, has a length of 0 bytes.

You can't use these symbols directly in a remark. You can use them if they're in quotation marks. The following remark would not produce redirection:

```
REM "Use the > key"
```

Most DOS devices can be accessed anytime; the CLOCK\$ device driver is a special case

In the September 27, 1988, User-to-User column, a table of standard DOS devices lists one called CLOCK\$. I could not find any reference to this device in the text or in the IBM DOS 3.1 manual.

As an experiment, I typed the following command on an IBM AT.

```
ECHO 7:30 > CLOCK$
```

When I checked the time and date, I got 32:16 and 10-11-2015! I rebooted the computer, but got the message, "Unable to set time, use setup disk." What is the proper method for using this device? —Daniel Moran; Rexford, New York

Although CLOCK\$ is casually referred to as a device, it's really just the device name used to access the device driver that finally interfaces with the device itself. The device controlled by the CLOCK\$ driver is the real-time clock.

A popular add-on for PCs and XT's, the real-time clock was one of the six features of the AST Six Pak Plus expansion board. Software included with the clock board usually included a special device driver that read the clock and transferred the information to DOS. The PC AT includes a real-time clock chip built right onto the system board. Because the address of the clock I/O ports were then fixed (and copied by clone makers), the need for an external device driver vanished.

The CLOCK\$ driver exists to allow DOS to read the time and date and use them to set its internal time and date counters. Usually called only when DOS is initializing, the CLOCK\$ driver transfers 6 bytes. The first 2 bytes are the number of days elapsed since 1-1-80. The remaining 4 bytes contain (in order) minutes, hours, 1/100ths of seconds, and seconds elapsed since midnight.

As you discovered, it is possible to write to the CLOCK\$ driver. The information sent must be 6 bytes of data in the same format as that read from the device. Changing the time usually requires running the SETUP program supplied with your machine or a special utility supplied by the board maker. Versions of DOS 3.3 and later, however, will update the real-time clock when you use the DOS TIME and DATE commands.



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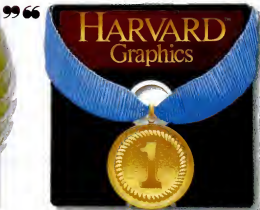


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■ PC TUTOR

Inside NUMLOCK.COM, and a more comprehensive explanation of keyboard lock functions

I just installed NUMLOCK.COM onto my hard disk using DEBUG as described in the PC Tutor of September 27, 1988. The directions were clear and concise, and creating the program was very easy. The article, however, didn't really provide an explanation of what I was doing. I don't feel comfortable using the same method to create other programs that turn NumLock on, CapsLock on, and CapsLock off.

I would appreciate it if you would tell me how to go about this. Or perhaps you could provide the necessary programs, as you did for NUMLOCK.—*Brian J. McKenna; Tampa, Florida*

Very basically speaking, the BIOS uses 3 bits of a byte located at 0:417h to keep track of the status of the NumLock, CapsLock, and ScrollLock functions. The mapping of this byte is shown in Figure 1. If the bit is 1, then the corresponding function is on. NUMLOCK simply sets bit 5 to 0.

For the ultimate control over the NumLock, CapsLock, and ScrollLock functions of your PC, I recommend TOGGLE.COM. Published in the May 31, 1988, Utilities column of *PC Magazine*, the article and assembly language source code provide an exhaustive tutorial on control of the keyboard. And the program is so small that you're better off using it than trying to

handle four separate utilities.

If you don't have that issue, the source code and executable version of TOGGLE and a brief explanation of how to use it are available for downloading from PC MagNet. (Instructions for accessing PC MagNet are given in the Utilities column of each issue.) To find a copy of the original text, check your local library for back issues of *PC Magazine*.

DOS redirection of input and output won't work with error messages

Something puzzles me about DOS. If drive D: exists on my PC, and the current directory is \BATCH, executing

```
CD D: | FIND /V "BATCH"
```

suppresses the output of the CD command as expected. But if drive D: doesn't exist, and I execute the command

```
CD D: | FIND /V "Invalid"
```

why doesn't this suppress the output "Invalid drive specification"?—*James A. Luedke, Jr.; Wellesley, Massachusetts*

The first part of the command CD D: asks DOS to print the complete drive and directory for the current path on drive D:. If the current directory was \BATCH, the CD command would write the string

```
D:\BATCH
```

to the standard output (STDOUT) de-

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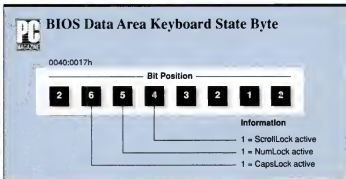


Figure 1: A mapping of the three bits in the primary keyboard byte that keep track of the status of CapsLock, NumLock, and ScrollLock.

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■ PC TUTOR

vice—in this case, the screen.

The pipe character tells DOS to connect the output of the command that precedes it to the input of the command that follows it. It does this by creating a temporary file on the current drive and directory. So a temporary file is created that contains only the string D:\BATCH.

In this case, the command that follows is the FIND program. FIND falls into the category of DOS programs known as filters. A computer filter works just as its equivalent in the real world does: it lets a portion of its input pass through on a selective basis. The FIND program has too many parameters to discuss fully in this column, but the DOS manual has a complete explanation.

FIND /V "BATCH" causes FIND to output all lines of input that do not contain the specified string. Because the two commands are joined by a pipe, the input to the FIND filter comes from the temporary file containing the output of the CD command. Since the only string available for input does contain the string "BATCH", all output is suppressed.

In the second case, where the referenced drive doesn't exist, something different takes place. DOS notes that the attempted execution of the command caused an error—the drive was invalid. Because errors are more important than normal messages, they are not sent to STDOUT. Instead, they are sent to the standard error device, STDERR. This output cannot be redirected using the pipe and is always sent to the screen. The result is that the error appears on the screen, nothing is written to the temporary file, and the FIND command has no effect.

If you want to suppress the output of most DOS commands under normal conditions, there's an easier way. Redirect the output to the NUL device like this:

```
CD D:\BATCH > NUL
```

The use of DOS functions is limited when writing interrupt handlers

I was intrigued by the program RAM-VIEW, which was published in the August, 1988, Utilities column of *PC Magazine*. I am trying to write a resident

program in assembly language. I was trying to use interrupt 21h function 2 to write to the screen inside my interrupt 9 keyboard routine, but failed. Could you show a sample program that does this?—Ozgur Basol; Izmir, Turkey

One of the basic principles of memory-resident programming is that generally you can't use any DOS functions. This restriction stems from the design of DOS itself.

Interrupt 9 is hardware generated and is triggered by a key press. Normally, it is handled by the BIOS without the knowledge of the program currently executing. A memory-resident program, however, can intercept this interrupt before it reaches the BIOS and use it to gain control of the system. This is how a hotkey works.

The BIOS routine that handles the INT 9 instruction is written with the knowledge that the current state of the machine is completely unknown and must be preserved. The computer could be reading characters from the keyboard, writing to the disk, or updating the screen: the interrupt 9 handler doesn't know what function was interrupted when it took control.

DOS is nonreentrant. This means that each DOS function must finish executing before another can begin. If DOS was in the middle of executing a function when the interrupt 9 handler gets control, trying to execute another DOS function will cause the machine to crash.

The rule is simple—don't use DOS functions in an interrupt handler. Like most rules, there are exceptions. Many of these are documented in the Utilities published in each issue. Study the source code provided to learn what is and isn't possible inside a memory-resident program.

Ask the PC Tutor

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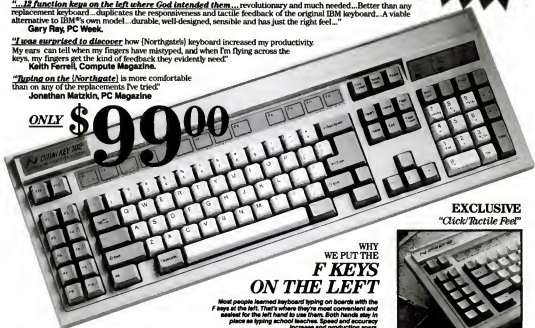
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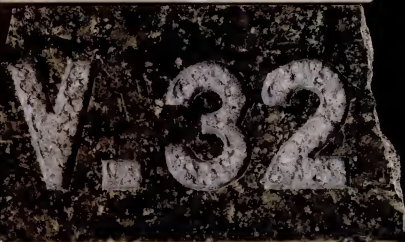
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■ CONNECTIVITY CLINIC

```

MOV BX,1                                ;CLOSE THE OUTPUT FILE
INT 21H
RANG_UP: MOV BX,OFFSET LACS              ;RANG UP THE SESSION
MOV LACS,PCB_COMMAND,IN_RANG_UP
CALL RETSYM
JNE DELETE_NAME
CALL WAIT MYSELF
JNE DELETE_NAME
DELETE_NAME: MOV LACS,PCB_COMMAND,IN_DELETE_NAME
CALL RETSYM                               ;REMOVE THE NAME FROM THE ADAPTER
JNE BAD_EXIT
CALL WAIT MYSELF
JNE BAD_EXIT
MOV AX,FFFF
INT 21H
BAD_EXIT: CALL ERROR_MSG
MOV AX,FFFF
INT 21H
WAIT_MYSELF: MOV AL,LACS,PCB_CMD_CPLT
CWD AL,FFFF
JZ TEST_CHAR
MOV AL,0
TEST_CHAR: MOV AX,1
INT 16H
JZ WAIT_MYSELF
MOV AX,0
INT 16H
ON AL,FFFF
MOV
WRITE_BUFFER PROC
MOV AX,0
MOV BX,1
INT 21H
RET
WRITE_BUFFER ENDP

RECEIVE_BUFFER PROC
MOV WORD PTR LACS,PCB_BUFFER,DI
MOV LACS,PCB_COMMAND,IN_RECEIVE
MOV LACS,PCB_LENGTH,SIZE_BUFFER,0
RESYM
MOV BX,OFFSET LACS
INT 21H
TEST AL,AL

```

```

;SET SWITCH FOR ONLY ONE MESSAGE
;PRINT OUT ERROR MESSAGE
;TO STANDARD DEVICE - NO REDIRECTION

;MOVE RETURN CODE TO AX
;ROUTINE TO CONVERT HEXART TO
;DEC

;PRINT OUT ERROR BUFFER,AL
PUSH CX
MOV CX,1
LEA CX,ERROR_BUFFER
PUSH BX
MOV BX,2
MOV AX,FFFF
INT 21H
POP BX
POP CX
DEC CX
JNE AGAIN
RET
ERROR_MSG ENDP

WAIT_CODE ENDP
WAIT_STACK
DW 1000 DUP (?)
WAIT_STACK
END

```

(Figure 1 ends)

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Greg Herrick, President
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■ CONNECTIVITY CLINIC

level programs you write.

The listing for IMPORT.ASM is given in Figure 1. However, the easiest way to obtain a copy of it, plus the corresponding .EXE file, is to download it by modem from PC Magnet. For instructions, see the sidebar "BCOPY by Modem" in this issue's Utilities column.

The NetBIOS module in each network node keeps a table of names. You set IMPORT to receive all messages addressed to a specific name using the syntax

```
IMPORT <session name> redirection symbol
<device name>
```

Each session name must be unique on the network. For example:

```
Import Frank >> messages.net
```

IMPORT loops until it receives a message addressed to that name from another user on NetBIOS, and then it terminates.

The following batch file will help if you

expect to receive messages or files while you are away from your computer:

MESSAGE.BAT

```
REN PRESS CTRL-C OR BREAK TO TERMINATE
:BEGIN
IMPORT FRANK >> MESSAGE.NET
LOOP BEGIN
EXIT
```

MESSAGE.BAT will append all NetBIOS messages sent to Frank to the MESSAGE.NET file.

In the next issue, I'll present the other half of this data-moving pair, EXPORT. Additionally, I'll discuss the networks that use NetBIOS and how the OS/2 LAN Manager works with NetBIOS.

Productivity Tip

In Connectivity Clinic, August 1988, I mentioned a book called *Inside NetBIOS*, written by Scott Haugdahl. Many of you

have written that you couldn't find it in your local bookstores. The publisher of Haugdahl's book, Architecture Technology, will send you a copy. Just call (612) 935-2035; yes, they take credit cards.

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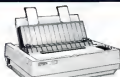
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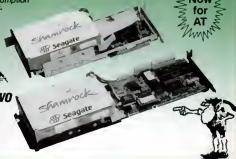
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Tandy 1000 Model

FREE SOFTWARE: TakeTwo, the backup utility PC MAGAZINE named Editors Choice in 1988 & 1987, & PC KWIK disk caching from Multisoft.

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DRIVE	ST138R	ST157R
SIZE/PERFORMANCE	32MB 40ms	49MB 28ms*
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*Average access speed per partition. Tandy 1000/A/SX/TX Leprecards add \$20



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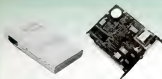
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286¹² Computer

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3/29/88—Power to Go: 12 New Portables Hit The Road—Pick Your Price And Performance. IBM's super-high PS/2 display adapter, 14 High Resolution, Big Screen Monitors For Desktop Publishing And All Applications; Connectivity Labs tests the Meridian LANStar PC; C-Scope, CALC function explained; A PC/LAN update, more.



3/15/88—Great graphics at your fingertips; PC Labs tests 7 PS/2 add-in memory boards; 10 top charting packages; 16 integrated word processors examined; LaserJet II font handling; C's scan function explained; tax preparation software; real-time images for big screens; FREE Asprin printing utility; more.



2/29/88—PC Labs tests 55 word processors; 1987 tax prep software; IBM's 20-MHz PS/2 Model 80 benchmarked; living with laser printers; keyboard monitors under OS/2; 12.3 competitor Surpass; PC Macrium; Primetime Personal time-management software; OS/2 Thinklink upgrade; Comnet comm software; more.



2/15/88—PC Labs tests 21 AT clones priced under \$2,000; mastering laser printing; 14 bargain spreadsheets; new mice from Micro-soft and Logitech; the first 5 VGA add-in cards; Univision's LifeNet; TSR calculator emulation programs, ColorsCan2, understanding OS/2 keyboard; FREE Run program; more.



1/25/88—IBM's OS/2 reviewed; PC Labs tests 20-MHz Desktop, do-it-yourself 386s; 17 Lotus 1.2.3 add-ins; add-ins for word processors, database management, and printing/graphics; sharing laser printers; Turbo Pascal 4.0; music programs; 6 new FAX boards examined; FREE Exit program; more.



1/12/88—THE BEST OF 1987—4th Annual Best & Worst Editors' Personal Picks; 1987 Awards for technical excellence; Tandem's 1000 Series; remote computing solutions; 4 Fiber-optic LANs; PC Labs tests 5 communications programs; 3 plug-and-play date transfer products; FREE Help utility; more.



12/22/87—Microsoft Excel reviewed; PC Labs tests 9 affordable 386-based PCs; 16 EGA Plus cards reviewed; 8 plotters; 6 TSR note-takers; 5 sales-lead trackers; Microsoft Windows; Omnis Quartz; Windows Graph; adding subdirectories and hard disk compatibility to rejuvenate old programs; FREE PRINTER.COM program printing utility; more.



12/8/87—15 hard disk storage cards examined; mail-order hard disks; 16 CAD packages priced under \$500; eBASE report writers; one-piece PCs; Word 4.0; E-Mail for LANs; the Price Waterhouse Report integrated accounting package; creating and using program libraries; FREE CD copy utility; more.



11/24/87—Apple's Macintosh II system examined; networking IBM and Macintosh; optimizing Turbo Pascal; Power Programming column premieres; 386 operating systems; 5 full-page, black-on-white monitors for CAD and desktop publishing; disk caching; FREE Stick cursor stabilizer utility; more.



11/10/87—PC Labs torture-tests 106 printers; 36 laser printers; \$1,795-\$18,750; 300-1200 dpi; 85 dot matrix printers; 5 daisy-wheel printers; soft-font primer; first look at Microsoft Excel; customizing cursors with CTYPE; Compaq Deskpro 386/20 and portable 386; FREE SAFARI internal error handling utility for PC DOS; more.



10/27/87—PC Labs tests 10 hot spreadsheets; 3-D spreadsheets that provide missing links; new models, new screens for laptops; 6 presentation-size monitors; 386 Turbo boards; the new MultiMate; text-oriented database software; FREE super clipboard utility works with any application; more.



10/13/87—Desktop publishing on the PC; PC Labs tests GEM Desktop Publisher, The Office Publisher, PageMaker and Ventura Publisher; the best large-screen monitors, laser printers, mice and scanners; 7 highest-speed AIs; 32 breakthrough text and graphics scanners; 31 spelling checkers; FREE pop-up address book and dialer; more.



9/29/87—PC Labs tests 12 hot 386 boxes; 12 keyboard macro programs; 13 full-featured project managers; laptop add-ons; A disk diagnostic programs; OS/2 and Languages columns premiere; first looks at Turbo C, IBM's Model 25; KBX keyboard extender examined; FREE RVN subdirectory utility; more.



8/87—36 high-tech input devices examined including tablets, track balls, touchscreens, light pens, mice and keyboard add-ons; 3 Norton challengers; 11 AT multi-function boards; 6 database graphic systems; TSR desktop organizers; 13 Siskelink rivals; FREE Directory Magic utility program; more.

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OS/2 EXTENDED EDITION Ever since IBM announced plans for four separate versions of its new operating system, OS/2 Extended Edition has been viewed as the most confusing. Don't miss this full-length review for a look at OS/2 EE 1.0 and contributing editor Charles Petzold's discussion of what it may offer to future applications.

CD-ROM LIBRARIES It's been said that there's a CD-ROM drive in every PC user's future, and the growing number of CD-ROM titles is already a part of life for many financial and legal professionals. *PC Magazine's* first CD-ROM roundup includes contributing editor Stephen Manes' overview of this technology and an evaluation of broad-based products from Grolier Electronic Publishing, H.W. Wilson, NEC, McGraw-Hill, Microsoft, Tri Star Publishing, and Ziff Communications.

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ETHERNET CARDS Now celebrating its 15th birthday, the Ethernet network cabling and signaling scheme remains a respected standard. This review of 13 Ethernet adapter cards—from such vendors as Acer, AST, Earth Computer, Gateway Communications, Novell, 3Com, Univa, and Western Digital—shows why Ethernet is still a wise choice. 28



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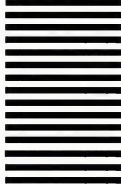
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AFTER HOURS



GAMES

King's Quest IV: The Latest and Best of the Series Adds MIDI Music, Mouse Support, and Enhanced Graphics

BY NEIL J. RUBENKING

Get ready to leave the world of ordinary text adventures and graphics-based games far, far behind. *King's Quest IV: The Perils of Rosella*, \$49.95 from Sierra On-line, is the first of a new generation of PC adventure games.

King's Quest IV is the first Sierra game created with the new SCI (Script Interpreter) development system, which replaces the old AGI (Adventure Game Interpreter) system. Doubled graphic resolution, MIDI music, mouse support, and improved parsing of user input are all due to the switch to SCI.

King's Quest IV comes on nine 5¼-inch floppy disks (or four 3½-inch disks) and requires 3.5MB of hard disk space. The perfect machine for playing the game is a fast 80386 with EGA or VGA, a large, fast hard disk, a mouse, and a supported MIDI board.

By adding a MIDI board to your system, you can play *King's Quest* with a symphonic background of multivoiced stereo music. Sierra went so far as to hire composer William Goldstein (who's composed music for TV, movies, and records) to write a MIDI score for the game. Each character actually has his own theme music.

If you lack a MIDI board and would like to preview the game's music, Sierra offers a cassette of its MIDI sound. If you like it, buy the AdLib Music Synthesizer Card (\$195) or the Roland MT-32 Sound Module (with interface and software, \$550) from Sierra.



In Tamir, the Princess Rosella is confronted with a forest full of menacing trees, which Sierra On-line imported straight from The Wizard of Oz.

All technological advances aside, just what is the latest *King's Quest* about anyway? The game follows the previous three *King's Quest* adventures chronologically, but it doesn't require you to be familiar with them.

A 10-minute "movie" sequence (in opulent MIDI stereo and high-resolution graphics) sets the stage for the action to come: Good King Graham has a heart attack, and Princess Rosella learns of a magic fruit in a distant land that could save his life. The fairy Genesta can bring her to the land of Tamir, but Rosella must also recover Genesta's stolen magic talisman. Without the talisman, Genesta will die and Rosella will never return home. The princess has a mere 24 hours to complete this dual quest.

After the conclusion of this dramatic introduction, Rosella is seen standing in peasant disguise on the coast of an unfamiliar country. At this point, you're in charge. You can use the arrow keys to guide Rosella around Tamir, but a mouse moves you more quickly from one location to the next.

Your first order of business is to roam the land of Tamir, mapping out the locations and evading any unpleasant folk. Keep your eyes open for useful objects, and take anything you can. Almost any object you can

find will be needed at some point. Talk to all the people or creatures that you meet, but be ready to run at a moment's notice.

It's important to explore everywhere; there are various tasks that you'll need to do to complete the game—all in a princessly fashion, of course. A familiarity with children's stories will definitely help you in fulfilling these missions. Besides the usual fairy tales, *King's Quest IV* draws on the *Wizard of Oz*, *Pinocchio*, and Greek mythology.

No matter how well versed you are on these topics, though,

you'll sometimes just get totally stuck. Die-hard gamers will put the game away until they come up with fresh ideas. But for those who are anxious to keep playing, help is available. You can call Sierra for a hint or ask for one through their electronic BBS. Or get *The Official Book of King's Quest*, which offers interesting background information as well as hints (see the sidebar "Playing King's Quest by the Book").

Does it make sense to soup up your 286 and buy a VGA and a MIDI board just to play a \$50 game? The answer is a definite... maybe. If nothing else, you'll certainly have a new answer for the friend who keeps asking, "Well, what can that computer of yours do?"

List Price: *King's Quest IV: The Perils of Rosella*, \$49.95.

Requires: 512K RAM; Tandy graphics, CGA, EGA, MCGA, or VGA; mouse/joystick optional; Roland MT-32, Ad Lib, or IBM music card optional; DOS 2.0 or later. AGI version can run with only 256K RAM, does not support mouse, music card. Not copy protected. Sierra On-line Inc., P.O. Box 485, Coarsesgold, CA 93614; (209) 683-4468, (209) 683-6858.

CIRCLE 662 ON READER SERVICE CARD

Playing King's Quest by the Book

Have you ever wondered how Sierra On-line actually makes its graphic games or how the company got its start? Or do you, like many *King's Quest* players, stay up nights wondering how you'll be able to ride the unicorn? *The Official Book of King's Quest: Davenport and Beyond*, by Donald B. Trivette (a frequent contributor to *PC Magazine*), has the answers to these questions and more. It offers a synopsis of each of the four *King's Quest* adventures, as well as help in the form of fairly subtle hints. More explicit hints are concealed in a crossword puzzle. But read with caution—if you haven't played the games, you may find that some of the hints give away too much.

The book contains maps that are handy for getting around the fairy-tale settings of the various quests. And the color screen shots of Sierra's game design software are something you won't see anywhere else. Buy this book for your favorite *King's Quest*. It's \$10.95 from COMPUTE! Books, (800) 346-6767.

—Neil J. Rubenking



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GAMES

Falcon AT: A No-Holds-Barred, Action-Packed F-16 Flight Simulator

BY JEFF PROSISE

A sweaty hand pulls back on the stick as your aircraft slowly noses off the runway and begins its steady ascent. One thousand, 2,000, 3,000 feet and climbing . . . and you roll into a steep banking turn to the northwest, soon to enter dangerous enemy territory.

Luckily, your F-16 Fighting Falcon is armed to the teeth with M61 cannon rounds and AIM-9L All Aspect Sidewinder air-to-air missiles in anticipation of battle. No sooner have you leveled off at 12,000 feet than the

your target acquisition equipment will have to be as accurate as your hand is steady; this one's going head-to-head . . . Wow! These guys mean business.

When Spectrum HoloByte set out to create a realistic F-16 flight simulator, it didn't settle for second best. *Falcon AT* (\$59.95) requires nothing less than an 80286 processor and an EGA or VGA graphics board. When you see its superb graphics, you'll understand why. This may be the most realistic simulator of General Dynamic's versatile F-16 fighter that money can buy.

At start-up, you choose a military rank (which determines the skill level of both you and your enemies), a mission, and the maximum number of MiGs that will come after you. You are pitted against hostile forces in 12 different missions—these



On-screen aerial acrobatics are particularly breathtaking when viewed from a spot plane. Here the F-16 executes a sharp roll and bank.



During a low-altitude bombing run over enemy ground installations, the Heads-Up Display shows critical information, such as angle of attack and air speed.

first blip appears on your bore-sight scan radar, tracking an on-coming Soviet-made MiG flying at the same altitude 24 miles distant.

The flip of a switch transforms your Heads-Up Display (HUD) to air combat mode, and you quickly assume a flight vector that will put you on a path to intercept the MiG.

Scan radar shows your target turning toward you and closing in at a rate of 845 knots. There'll be no time for guessing, and

range from simply locating and downing a renegade MiG fighter to destroying enemy ground installations.

All warfare takes place over a detailed landscape complete with buildings, bridges, lakes, mountains, airfields, and ground vehicles—all of which are shown in 3-D.

To help you navigate around *Falcon AT*'s world, the Combined Electronics/Map Display (COMED) can be switched to show a colorful overhead view

of the entire area. If you stray outside charted territory, an unseen ground controller flashes messages across your Heads-Up Display to guide you safely back. And if you have trouble locating your targets, the same controller sends out helpful instructions concerning the enemy's bearing and distance from your current position.

Before you fly, you'll have to become familiar with an intimidating array of cockpit instruments and weapon systems. The cockpit is crammed so full of gauges and digital indicators that you'll have to go to side views to see some of them. You arm your F-16 fighter as you choose or let the ground crew do it for you.

The sheer level of detail of this simulation requires that you spend a few cozy hours learning to take off, maneuver, land, and use your armament and tracking systems with the manual close at hand. The pause key will probably be your closest friend in the early going.

Once you get comfortable with the aircraft, it pays off in a big way. It's easy to get glued to *Falcon AT* for hours, caught up in the pursuit of enemy forces and the attempt to best your top score.

As you fly, you can look out of the F-16's cockpit in any of four different directions or even watch from a trailing spot plane

or the control tower. Aerial acrobatics are particularly dramatic when seen from an outside view.

The well-written manual details everything you'll ever want to know about G-forces, stalls, fuel consumption, and combat maneuvers. Your fighter even includes a black box flight recorder that lets you play back your performances. And if you ever tire of taking on canned missions, just connect your AT to a friend's computer with a null modem cable and dogfight each other in *Falcon AT*'s two-player mode.

Falcon AT is everything you'd expect from a first-rate fighter game. The question arises, Is there anything it won't do? Well, yes. You don't feel the thud of an enemy's rocket as it hits your plane or the heart-throbbing burst of acceleration as you send one of theirs plummeting to the ground, but Spectrum HoloByte is undoubtedly working on that for its next release.

List Price: *Falcon AT*, \$59.95. **Requires:** 512K RAM, 80286 or 80386 machine, EGA or VGA graphics adapter, joystick optional, DOS 2.0 or later. Not copy protected. Spectrum HoloByte, 2061 Challenger Dr., Alameda, CA 94501; (415) 522-3584.

CIRCLE 663 ON READER SERVICE CARD

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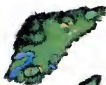
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AFTER HOURS



GAMES

Zak McKracken Saves the World from Stupidity

BY BILL O'BRIEN

In Lucasfilm's latest electronic drama, *Zak McKracken and the Alien Mindbenders*, poor Zak must defeat the ignoble Caponian aliens who have rigged the world's phone system to produce a terrible noise that induces stupidity in humans.

Zak must travel across countries, oceans, and the cold airless reaches of outer space to Mars in order to collect the six segments of a device that will thrash the evil Caponians. In the process he meets Annie, the girl of his dreams (sigh!) and is assisted by her cohorts, Leslie and Melissa, who have traveled to Mars in a VW microbus that they converted into a spaceship (well, they are Yale coeds and this is fantasy).

By the way, Zak doesn't own a spaceship or even a space suit. In fact, he's a lowly reporter for the *National Inquisitor*, a sleazy, sensationalistic tabloid. (You'll find the March 29, 1997, issue in the game's box. Hold on to it—you'll find clues hidden in its stories. If you need further help, Lucasfilm sells a

hint book for \$7.95.)

Lucasfilm has made Zak and his friends pretty durable. However, Leslie and Melissa are on Mars and need periodic oxygen refills. If you place them in situations where they cannot reach their main supply in time, they'll die. Of course, Zak also needs air when he gets to Mars. Besides that, he's susceptible to drowning in the Atlantic Ocean or being torn to shreds by cranky grave guardians.

Zak combines truly impressive computer-generated music with high-quality animation. Zak automatically knows what video adapter you're using and will work with everything from Hercules through EGA and Tandy 16-color mode. You can play the game with the keyboard, but a joystick or mouse works better.

You'll find it difficult to stop playing *Zak McKracken*, even for some of life's smaller amenities (such as eating dinner or breathing). It's an excellent game—you'll laugh, you'll cry, you'll kiss \$44.95 good-bye, but you'll enjoy yourself.

List Price: *Zak McKracken and the Alien Mindbenders*, \$44.95; **Hint Book**, \$7.95. **Requires:** 256K RAM, graphics adapter, DOS 2.0 or later. Copy protected through documentation. Lucasfilm Games, P.O. Box 10307, San Rafael, CA 94912; (415) 662-1966.

CIRCLE 845 ON READER SERVICE CARD



Sample games such as *Squynch*, which were created using AGT, are included to help you get a feel for creating your own text adventures.



GAMES

Help for Would-be Game Designers

BY DONALD B. TRIVETTE

Softworks' *Adventure Game Toolkit* gives the devoted PC game junkie the chance to be more than just another player. The \$35 program puts you in charge by providing you with the tools you need to build your own text adventure games.

Using the standard level of AGT, anyone with an ounce of imagination can create a text game. You use your own word processor or text editor to write a script file according to rules described in the AGT manual. For instance, the file must contain a description of each screen or room. You also define verbs, nouns, and creatures.

Room descriptions are pretty much up to you, but there are rules for creating nouns, verbs, and creatures. For example, no player can lift an object heavier than 100 pounds, even if it is defined as movable. The AGT manual is full of advice: "Provision should be made for killing hostile creatures." The only thing worse than having Big Foot in your adventure is not having a way to eliminate him.

Although the standard level of AGT is easy to use, the games it produces are rather limited.

That's why AGT also has a professional level, which generates games similar in layout and sophistication to those made by Infocom and other commercial developers. The professional level uses an English-like meta-language to give you more control. With it, you can define a new verb and describe the conditions and actions it may cause. Of course, with flexibility comes complexity—it could take months to write a professional adventure game with hundreds of nouns and verbs.

Once the file is complete, it must be compiled using the AGT software. This puts it into a form that can be played and distributed to others.

Sample games that were created with AGT are also included. So after designing your own masterpiece, you might unwind with CAVE (a version of *Colossal Cave*, the great granddaddy of all adventure games), or the interestingly named *Squynch* or *Paranoia*.

List Price: *Adventure Game Toolkit*, \$35 (\$20 without manual). **Requires:** 384K RAM, DOS 2.1 or later. Not copy protected. Softworks, 43064 Via Moraga, Fremont, CA 94539; (415) 659-0533.

CIRCLE 844 ON READER SERVICE CARD



Zak McKracken must destroy the Caponian aliens, who are intent on making human beings irreparably stupid. Annie, the girl of his dreams, is on hand to help.

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AFTER HOURS



GAMES

Battling Daimyos and Warlords For Control of Far Eastern Lands

BY M. STEPHANIE RICKS

Nobunaga's Ambition and *Romance of the Three Kingdoms*, from Japan's Koei Corp., bring the drama of wartime adventure, with a Far Eastern twist, to your computer screen.

Nobunaga's Ambition

Nobunaga's Ambition (\$59.95) is based on events that occurred in Japan nearly 400 years ago. Prior to the 17th century, Japan was divided into more than 100 counties; Oda Nobunaga was the first general to begin to unite these counties into one nation. Now you must complete his work and consolidate Japan under one *Tono* (lord).

You can play alone against the computer or with seven adventurous friends. Each player is granted a single *kuni* (fief) and the title of *daimyo* (leader). You select the daimyo character you will portray and his "personality" traits.

The action takes place on a graphically detailed map of Japan. In your quest to unite the country, you may elect to sign a nonaggression pact with your enemies or marry a neighboring daimyo's daughter to gain control of his land.

When diplomacy fails, you simply go to war. You can lead your troops into battle or safely wait out the conflict at headquarters. When a battle is successful, you reap the rewards of victory. Failure precipitates mind-numbing consequences. **List Price:** *Nobunaga's Ambition*, \$59.95. **Requires:** 250K RAM, DOS 2.0 or later. Copy protected. Koei Corp., 20000 Mariner Ave., #100, Torrance, CA 90503; (213) 542-6444.

CIRCLE 667 ON READER SERVICE CARD

Romance of the Three Kingdoms

Romance of the Three Kingdoms, also a game for one to eight players, offers you the task of uniting third-century China. This time your enemies are three renegade generals who have seized control of some of the country's isolated provinces. The \$69.95 *Romance* is a series of five chronological playing scenarios that lead you from "A Chaotic World," where you must capture 30 states and govern two capital cities, to "The Age of the Three Kingdoms," where you must unite the entire empire.

You take on the persona of a warlord and then begin amassing your provinces. At your disposal are castles, rice, soldiers,



In *Nobunaga's Ambition*, you take on the role of a daimyo. You select your character's "personality" traits, such as luck, intellect, and ambition.

mercenaries, beautiful women, and horses.

Romance of the Three Kingdoms lets you wage war against both the charismatic generals and a host of natural disasters, including floods that can devastate your entire army. As if that weren't enough, the peasants, not a cheerful lot, are always revolting.

You can play in rational or warlike mode. If you choose the latter, you'll be subject to frequent and reckless enemy attack; in rational mode, game play is crafty and ominous.

Nobunaga's Ambition and *Romance of the Three Kingdoms* both take a while to get up

and running; the sheer number of commands is daunting. The manuals are crammed with instructions, historical summaries, biographies, calendars, game strategies, and even pronunciation guides.

For such a staunch pacifist as myself, *Nobunaga's Ambition* and *Romance of the Three Kingdoms* offered hours of riveting and intelligent playtime.

List Price: *Romance of the Three Kingdoms*, \$69.95. **Requires:** 250K RAM, DOS 2.0 or later. Copy protected. Koei Corp., 20000 Mariner Ave., #100, Torrance, CA 90503; (213) 542-6444.

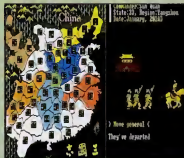
CIRCLE 668 ON READER SERVICE CARD

AFTER HOURS INDEX

Zak McKracken

Can Zak McKracken save the world from stupidity?
Adventure Game Toolkit
How to design your own text adventure game.
Falcon AT
High-flying entertainment.
King's Quest IV
The fourth game in the popular series offers enhanced graphics and MIDI music support.

In *Romance of the Three Kingdoms*, Sun Quan of China's Yangtze region commands his soldiers to attack a neighboring territory.



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